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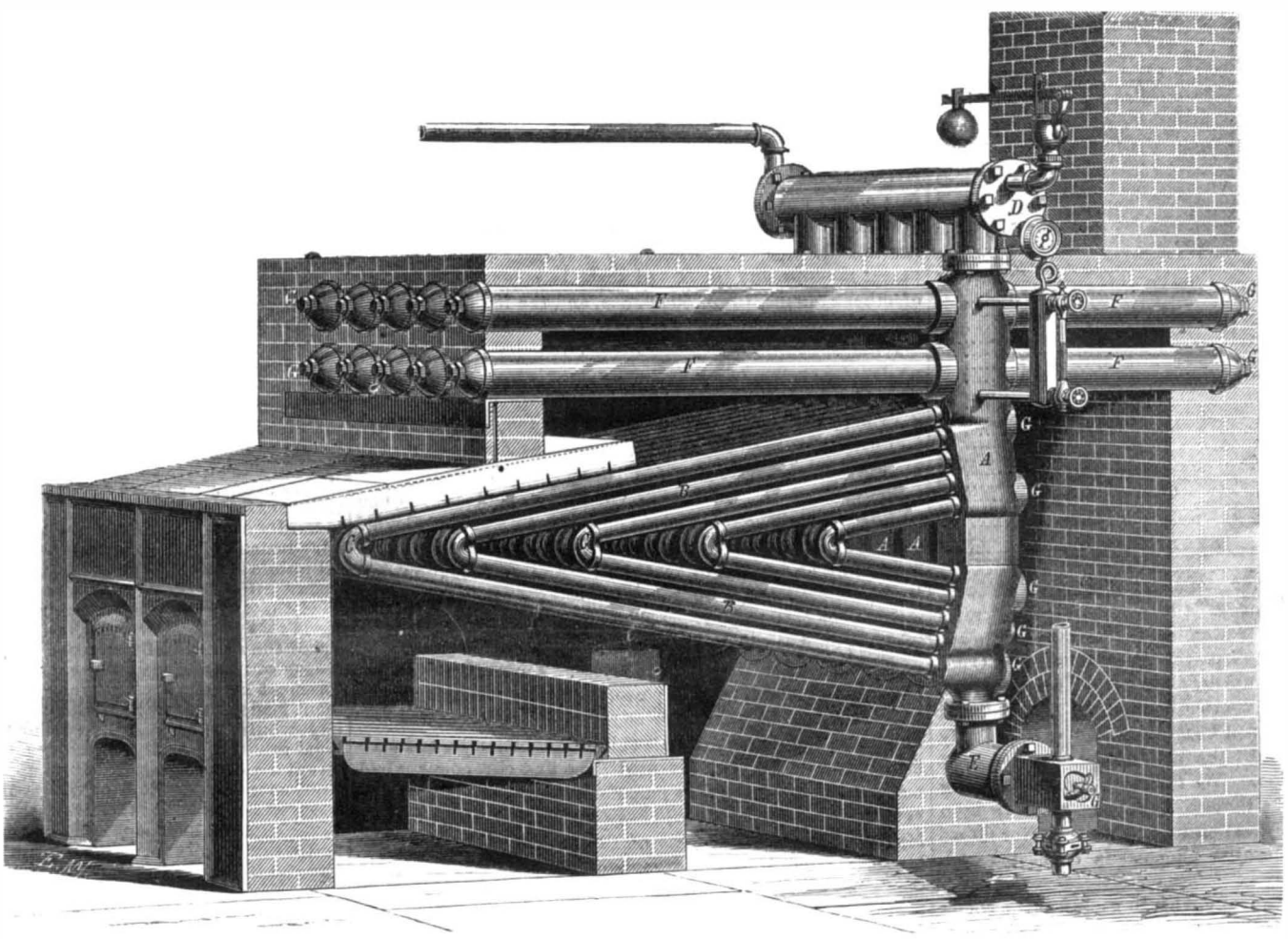
THE ECLIPSE STEAM GENERATOR.

We illustrate herewith an improved form of the Eclipse steam generator, a sectional boiler which was described in these columns several months since. The invention, as modified, is claimed to combine safety, durability, and economy with cheapness of construction and facility of repairs.

The boiler, we are informed, has been used for driving all classes of machinery with great success. The improved method of construction now adopted allows any tube to be easily removed, replaced, or entire sections detached or added, without interfering with other parts of the generator.

The water and steam chambers, A, are of ample size, made of semi-steel, and so formed that the steam can rise to the surface and the water freely return to the lower tubes. The tubes, B, are lapwelded, and the bends, C, are semi-steel. These parts, being exposed to the fire, are arranged so as to allow for expansion and contraction, and provide for complete circulation. The top or roof pipes, F, are used, the lower row for carrying a supply of water and the upper for drying the steam. There are hand holes, G, in the ends of each roof pipe, F, for the purpose of cleaning; also hand holes in the backs of all the chambers, A, so situated that any and every one of the circulating tubes, B, can be commanded their entire inside length, or detached if ever necessary, without disturbing the upright or main parts. The space between each tube will allow the removal of any < without disturbing another.



THE ECLIPSE STEAM GENERATOR.

The object of giving the tubes the <, or angular, shape is to secure the greatest possible amount of heating surface of a continual upward incline, and to allow of unequal expansion. If one arm of the < becomes longer from the heat, the other will springs up or down to accommodate itself, without opening a joint. The water has a complete circulation, running up the inclined tubes, B, and falling down in the sections, A. This is caused by the steam and hot water rising to the surface, and the colder water rushing to its place. The upright return chambers, A, are large enough for the free passage of the water from the exhaust or top openings of the tubes to the lower. This secures a continued and uninterrupted circulation up through all the inclined tubes, B (which are immediately over the fire), and back down the sections, A, where there is larger volume and less effect from the furnace. The steam, as generated, escapes to the upper part of the boiler. The sediments settle in the drum, E, below the fire surface, where they can do no injury and can be readily removed. The heating surfaces are kept clean by this arrangement.

There are no chambers exposed to the action of the heat sufficiently large to cause a destructive explosion. The boiler is short, so that all parts are brought into close proximity to the fire. No packing or caulking is said to be necessary. The joints are ground iron to iron. The tubes are attached with improved lock nuts which can be unloosed at any time, and every part is easy of access for cleaning or repairs.

It is claimed that the bulk of the water, being carried in the upper part of the boiler, prevents the heating surfaces from becoming dry so long as any water remains in the generator. This obviates the necessity of having large water chambers for a reserved supply, while requiring but little attention to keep the water at a proper level.

For further particulars address the Eclipse Steam Manufacturing Company, Sharpsburg, Pa. Information can also be had at their branch office, 87 Wood street, Pittsburgh, Pa., or of the general agent, Isaac H. Shearman, 45 Cortlandt street, New York city, and 132 North 3d street, Philadelphia, Pa.

Electricity Produced in Mechanical Actions.

Certain phenomena of electricity of tension, observed in leather belting by M. Joulin, have recently been the means of directing the attention of that physicist to the subject forming the above heading. He has constructed machines in which the mechanical tension of the belt can be varied at will, and has used for conducting pulleys the following materials: Iron, brass, zinc, red copper, white iron, lead (the last four metals applied in thin laminæ to wooden pulleys); the imperfect conductors, walnut wood, leather, hardened rubber, in sheets of 0 36 inch, applied to wood; cloth and silk fastened in form of cushions, also to wooden pulleys.

In the machines formed of metal and leather, in the latter body electric tensions of surprising intensity were found. Independently of the long sparks obtainable, a metallic wire brought near the belt was traversed with a continuous current powerful enough to deflect the needle of a galvanometer, with electricity of tension to weakly decompose water, and in slightly modified Geissler tubes to produce a distinct stratification of the electric light. The circumstances influencing the electric production may be referred to three causes: separation, more or less rapid, of the bodies; the complex mechanical action of incurvation, depending, in the case of leather, on the elastic state and dimensions of the pulley, and the number of incurvations in a given time; lastly, the common temperature of the two bodies or that of one of them.

Sirius.

At a recent meeting of the Royal Astronomical Society, a paper on Sirius, by Mr. J. M. Wilson, was read. His observations tended to confirm the speculations of spectroscopists that Sirius is intrinsically much brighter than the sun, and must, therefore, be of a higher temperature. His measures of the position of the companion of Sirius showed that it is now passing away from its periasteon, and that the time of a complete orbital revolution is probably nearly two hundred years. Taking the parallax of Sirius as 0·22″, the distance of the companion from the principal star is about fifty times the earth's distance from the sun. This would give the mass of Sirius as only 3⅓ times the mass of the sun, while the amount of its light is estimated at more than two hundred times the light of the sun. He therefore concluded, that, area for area, Sirius must be much more intensely luminous than the sun. He wished to direct attention to the companion of Sirius, and to point out that it is within the reach of instruments of only moderate aperture. The telescope with which his observations have been made is a refractor of 8¼ inches. He has ordinarily used a power of 400.

Mr. Mattieu Williams said that it seemed to be assumed that increased brightness was necessarily an indication of increase of temperature; but that though this might be true for solids, it did not follow that it was true for gaseous bodies. When one gas flame was placed behind another, the brightness was doubled, but the temperature remained the same.

Mr. Ranyard said that the speculations of spectroscopists as to the heat of Sirius were founded on the blueness of its light rather than on its general brightness.

Check Chains on Car Trucks.

At the recent session of the Master Car Builders, the merits, *pro* and *con*, of check chains were discussed. A large number of accidents were cited, in some of which the trucks had the chains and in others no chains. Some of the members thought the chains were of no value, but the mass of the evidence was in favor of their use, and the report of the committee to that effect was adopted. Members believed that every truck ought to have four strong check chains. The committee say:

"Check chains, as usually applied, with eye bolts through the truck sides and sill of the car, are defective from being so placed that the full strength of the timber is not available, as the strain is down and sideways on the sill, and usually tears out the lower portion of it, leaving the upper part in place, and with the truck *vice versâ*. Where hook or eye plates are bolted to the truck side and sill, the strain bears on the bolt nearest to the hook or eye, and the result is that either the bolts or timber break and give way in detail; and in cases where lag or wood screws are used, the result is the same.

"In order to have check chains of value, they should be of such proportion that their strength will be equal to the resistance of the timbers to which they are attached, and the fastenings to the timber should be so constructed that the full strength of the timber would be utilized. The point of attaching chains to truck and car body, respectively, should be such that the chains would be at right angles to the body of the car when the chains are drawn taut, and the length of chain just sufficient to admit of running the shortest curves with safety.

"There are different methods of attachment to the sill or a special timber, so that the full strength of the timber can be made available. One method, which your committee would recommend, is to place an iron plate of suitable size and strength on the inside of the sill with an angle turned over, and extending half across the top of the sill, and an eye to receive a ring at the lower end of plate near the lower inside corner of sill; also a similar plate on the opposite side, with an angle extending half across the top, and another angle at the lower outside corner; the plate extending across the bottom of sill to near the inside corner, with an eye to receive the ring above referred to; then by bolting through the plates and sill, and the ends of the plates being drawn together by the ring passing through the eye near the ends, the sill or timber is securely inclosed, and, with the irons properly proportioned, its strength is fully utilized."

Oil Tank Cars.—On the Atlantic and Great Western Railroad, these tanks are made of three sixteenths iron, and are sixty-one inches in diameter. They hold eighty-five barrels. They resemble cylindrical boilers; are fitted with man hole, dome, filling and draw cocks, and are strapped down to platform cars by means of plate iron bands. The arrangement is cheap, safe, simple and durable. Pipe lines leading from the wells to the railroad stations convey the oil, which pours directly into the tank cars.

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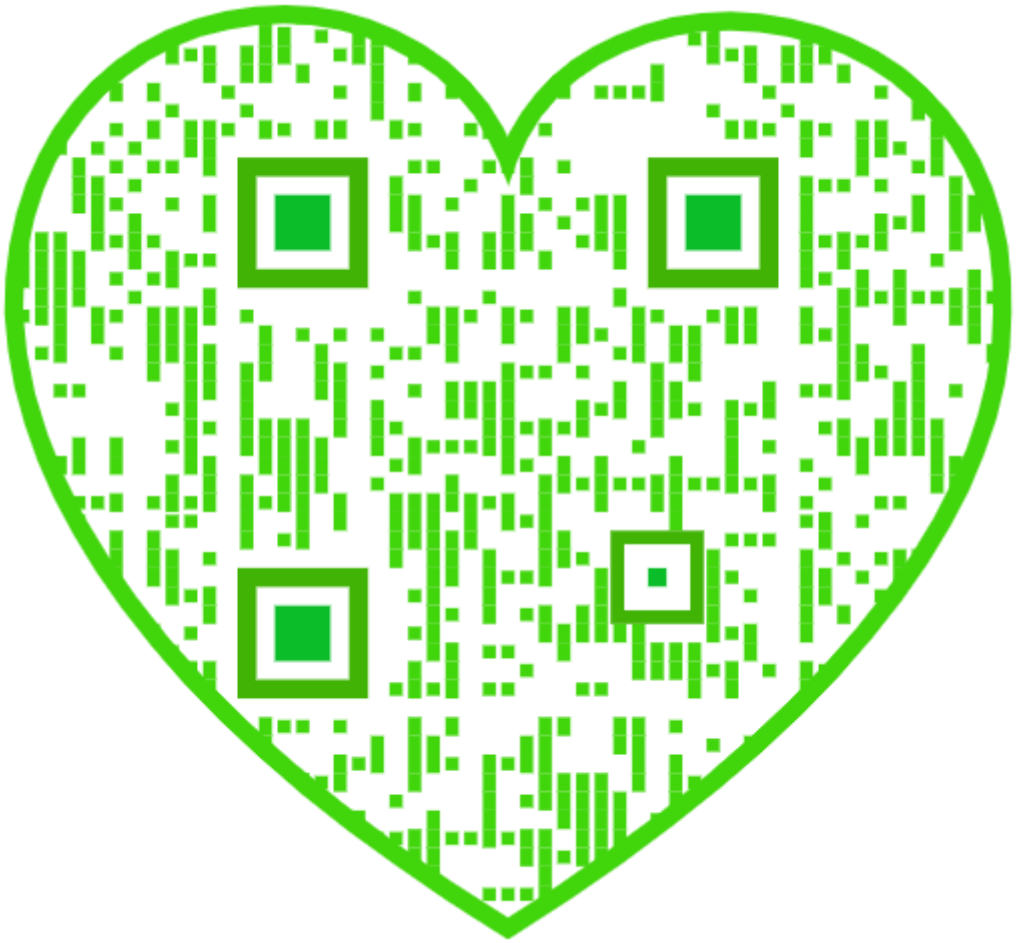

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A COMETARY RETROSPECT.

From recent calculations of the elements of Coggia's comet by Mr. Plummer, an English astronomer, there appears to be a close similarity between them and those of Comet II of 1737. There is a sufficient correspondence, it seems, to warrant the belief that the two comets are identical, and that we are receiving a second visit from the vagrant body which attracted the notice of the astronomers of a hundred and thirty-seven years ago. We find no record of its being a very prominent object, although it appears to have been observed in many of the great cities of Europe. Nor do we find statements of any peculiar phenomena connected with its appearance.

There will doubtless be many who, in gazing at the comet night after night as it gradually augments in brilliancy, will ponder as we have over the vast progress which the world has made since the era of the former visitation.

Looking at the condition of Science in 1737, from our present standpoint, it is easier to regard the circumstances negatively, to imagine our own condition if deprived of the results of discovery and of progress which have accumulated in the intervening years. The spot, on which the building in which we now are stands, was then but a green meadow. The crowded metropolis was existing only in the germ, and that merely a few straggling streets close to the water's edge. George II. was on the throne of England, and Louis XV. on that of France. Both amiable sovereigns were struggling to monopolize as much of North America as possible; and although at the time peace reigned in the colonies, it was but a temporary one, which ended in still fiercer hostilities seven years later. Sir Isaac Newton had been dead for six years, and the mathematicians of England were arrayed against those of the continent, squabbling and bickering, with an acrimony intensified by international jealousy, over the theory of gravitation. Newton had studied out the subject of electricity and had invented the glass globe machine. Stephen Gray had also made some investigations, but no one had ventured a theory, nor had an application of the new phenomena been suggested. Telegraphy, the galvanic battery, the innumerable inventions based thereon, were all things of the future. There were plenty of alchemists in Europe, and the science of chemistry was just wrenching itself free from connection with their chimerical fancies. Stahl had but recently announced his theory of philogiston, a substance which Cavendish in subsequent discoveries believed identical with hydrogen. But the transition period in chemical science was yet nearly forty years distant. Priestley, the discoverer of oxygen, was but an infant. Black, the investigator of the alkalies, and Scheele, the inventor of modern organic analysis, were likewise children. Out of the sixty-three elements, but fifteen were known. Aluminum, chlorine, oxygen, hydrogen, nitrogen, platinum, and nickel were among those which had never been recognized.

Newcomen's steam engine was used in the mining districts, and the boy, who sat beside it and worked the condenser valves, had not been struck with the brilliant idea of making catches and strings perform the labor in his stead. The Marquis of Worcester and James Watt were unknown to fame. The first railroads were in use in the coal districts of Northumberland and Durham, but the rails were nothing more than wooden beams, and iron was not to be substituted for them for thirty years. In the blast furnaces wooden bellows were in use. Puddling, rolling, and the hot blast were unknown. In Europe cast steel had never been made, and but a short time had elapsed since the publication of Réaumur's work, making known the process of manufacturing ordinary steel. In this country Jonah Higby's patent, obtained from the Connecticut legislature, for a "curious art to transmit common iron into good steel" had just run its term of ten years. Having no autonomy as a nation, we had no patent right system in those days, and even civilized France had made no effort toward establishing one. The arts of photography or sun painting in any form were undreamed of. The sciences of aeronautics and of agricultural chemistry had never been imagined. Surgeons hacked off the limbs of their victims and seared the flesh with red hot irons, regardless of the agony they inflicted, for anæsthetics were unknown. The phenomena of digestion were but little understood, and quinine, with hundreds of other remedies now common, had not been discovered.

Whale oil was burned in the lamps, which formed the sole means of illumination when candles were absent. Petroleum, paraffin, and illuminating gas were yet to be found. In artillery and implements of war, the bayonet had just superseded the pike, the flint lock musket was just coming into use, while a single monster cannon of the present day would have dispersed whole regiments armed with the primitive artillery then employed.

Laplace had not given his labors to the world. Saturn's rings and satellites had not been discovered, and the path of that planet was supposed to be the outer bound of our solar system. The spectroscope had made none of its wonderful revelations, and the distances of the fixed stars, their apparent motions, and the fact of their being suns and centers of other systems, the 5,700 nebulæ, and the 136 asteroids, all were unknown.

India rubber had been discovered one year. There was no definite system of botany, and Cuvier's researches in natural history had not appeared. The caloric engine, the hydraulic press and ram, the sewing machine, and the diving bell had never been thought of. Blowpipe analysis and the atomic theory, a system of logarithms, calico printing, the steam printing press, all were yet to be invented. No one had deciphered the inscriptions on the monuments of Egypt. Jenner had not introduced vaccination, nor Hahnemann homœopathy as a school of medicine. Steam navigation and the screw propeller were yet to appear. Captain Cook was making his celebrated voyages around the world. Immense portions of Australia, of Africa, of the polar regions, had never been visited by civilized races. Anthracite coal had never been burned, nor the powerful explosives now known to Science used to tear rocks asunder. Dentistry was unknown as a profession on this side of the Atlantic, and artificial teeth had not been invented. The first chronometer had not been completed. The pianoforte was a new-fangled invention, which no one would have aught to do with until his Majesty Frederick the Great of Prussia deigned to buy one ten years later. Polarized light had not been discovered. No post office system had been developed by any government, nor had any improved means of teaching the deaf and dumb been adopted. Steel pens were unknown, and the SCIENTIFIC AMERICAN was not one of the seven newspapers then existing in North America.

Our retrospect already extends beyond intended limits, and we have far from even summarized the great discoveries of the past century and a half. That our descendants will surpass us as much as we do our ancestors is within every bound of probability. When our celestial visitor again appears, as it will in the year 2011, it will reveal itself to the gaze of earthly inhabitants, regarding the magnitude of whose knowledge and whose powers it would be idle even to speculate.

TAXING POWER OF THE LEGISLATURE.

Law, in its true sense, is the product of the highest reason coupled with the most exact justice. The Civil or Roman Law and the Common Law of England are to be admired as models. The great deviations from genuine law are to be found in arbitrary acts of our State Legislatures, seriously affecting the rights, liberties, and property of individuals, and the tendency of the courts to give validity to such acts in contravention of constitutional guaranties and those of the common law.

The most notable instance of this may be found in such legislative acts as provide for the disbursement of large sums of money in making public improvements, and then charging the whole cost as a tax on specific individual property without the consent of the owners, and, as has sometimes happened, to the entire confiscation of the property. The power of the legislature to do this, and to act as the final judge on the propriety of any public improvement, from which the individual has no redress, although ruined thereby, is now, as we understand the law, laid down by the Court of Appeals of the State of New York.

This doctrine is so arbitrary in form and so destructive of individual rights that it becomes a relief to know that our sister State of New Jersey, through Chief Justice Beasley, of its Court of Errors and Appeals, lays down a much milder and wiser rule for that State, in a recent decision made by him at the suit of "The Mayor and Common Council of Newark *ads.* The State, *Agens et al.*

The facts were that a certain street in Newark had been repaired under an act of the legislature which provided that two thirds of the cost should be imposed on the owners of lots fronting on the line of the improvement, and one third on the city treasury; and the question was whether the legislature could fix, at its mere will, the ratio of expense to be put upon the owners of the property along the line of the improvement. The following is an extract from the very able opinion of the Chief Justice, fully concurred in by his associates, and well worthy the attention of the courts of this and other States:

"* * * That the effect of such laws may not extend beyond certain prescribed limits is perfectly indisputable. It is upon this principle that taxes, raised in counties, towns, and cities, are vindicated. But while it is thus clear that the burthens of a particular tax may be placed exclusively on any political district to whose benefit such tax is to ensure, it seems to me it is equally clear that, when such burthen is sought to be imposed on particular lands, not in themselves constituting a political subdivision of the State, we at once approach the line which is the boundary between acts of taxation and acts of confiscation. I think it impossible to assert, with the least show of reason, that the legislative right to select the subject of taxation is not a limited right. For it would seem much more in accordance with correct theory to maintain that the power of selection of the property to be taxed cannot be contracted to narrower bounds than the political district within which it is to operate, than that such power is entirely illimitable.

If such prerogative has no trammel or circumscription, then it follows that the entire burthen of one of these public improvements can be placed by the force of the legislative will on the property of a few enumerated citizens, or even on that of a single citizen. In a government in which the legislative power is not omnipotent, and in which it is a fundamental axiom that private property cannot be taken without just compensation, the existence of an unlimited right in the law-making power to concentrate the burthen of a tax upon specified property does not exist. If a statute should direct a certain street in a city to be paved, and the expense of such paving to be assessed on the houses standing at the four corners of such street, this would not be an act of taxation, and it is presumed that no one would assert it to be such. If this cannot be maintained, then it follows that it is conceded that the legislative power in question is not completely arbitrary. It has its limits, and the only inquiry is where that limit is to be placed. * * *

So far as the particularized property is specially benefited, an exaction to that extent will not be a condemnation of property to the public use, because an equivalent is returned, and this is the ground on which the abnormal burthen put upon the land owner is justified.

Speaking on this subject, Chief Justice Green says: 'The theory upon which such assessments are sustained, as a legitimate exercise of the taxing power, is that the party assessed is locally and peculiarly benefited, over and above the ordinary benefit which, as one of the community, he receives in all public improvements, to the precise extent of the assessment." ("State *v.* City of Newark, 3 Dutch. 190.) It follows, then, that these local assessments are justifiable on the ground alone that the locality is especially to be benefited by the outlay of the money to be raised. Unless this is the case, no reason can be assigned why the tax is not general. An assessment laid on property along a city street for an improvement made in another street in a distant part of the same city would be universally condemned, both on moral and legal grounds. And yet there is no difference between such an extortion and the requisition upon a land owner to pay for a public improvement over and above the exceptive benefit received by him. It is true that the power of taxing is one of the high and indispensable prerogatives of the government, and it can be only in cases free from all doubt that its exercise can be declared by the courts to be illegal. But such a case, if it can ever arise, is certainly presented when property is specified out of which a public improvement is to be paid for, in excess of the value specially imparted to it by such improvement. As to such excess, I cannot distinguish an act exacting its payment from the exercise of the power of eminent domain. In case of taxation the citizen pays his quota of the common burthen; when his land is sequestered for the public use, he contributes more than such quota; and this is the distinction between the effect of the exercise of the taxing power and that of eminent domain. When, then, the overplus beyond benefits from these local improvements is laid upon a few landowners, such citizens, with respect to such surplus, are required to defray more than their share of the public outlay, and the coercive act is not within the proper scope of the power to tax. And as it does not seem practicable to define the area upon which a tax can be legitimately laid, and beyond which it cannot be legitimately extended, and as there is, as has been shown, necessarily a limit to the power of selection in such instances, the principle stated in the case cited is, perhaps, the only one that can be devised whereby to graduate the power. Consequently, when the improvement, as in the present instance, is primarily for the public welfare, and is only incidentally for the benefit of the landowner, the rule thus established ought to be rigidly applied and adhered to."

A full review of this able decision and the cases it cites would interest and instruct all lovers of sound law. It imparts the good old doctrine that States and Legislatures are only the product of an aggregate of individuals, created alike for the general and individual good, and not to be the means of oppression or extortion of the highest or the most weak and humble citizen.

RECENT PRINTING PRESS IMPROVEMENTS.

In the working of nearly all printing presses the sheets of paper are supplied by hand, the workman being known as a "feeder." Each sheet must be taken up singly and exactly placed on the feed board, where it can be seized by the press nippers at the proper moment, and carried to the types. Any carelessness on the part of the feeder results in bad printing and the spoiling of sheets. Measured by the manual force expended, the feeder's labor is slight; but no press can be run, not even for the smallest job, unless the feeder is on hand to place the sheets, while his inexorable weekly wages are a serious expense in every printing office. Many have been the attempts made, extending over a period of twenty-

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five years past, to substitute mechanism for this species of hand labor, but without much success until the present time. We have recently had the pleasure of witnessing, at the extensive press rooms of the *Independent* newspaper, Rose street, in this city, the practical operation of a mechanical feeder which is, apparently, the perfection of success. It takes up the sheets separately upon a steel point, carries them forward and delivers them to the nippers, between the adjustable guides, with almost infallible accuracy. Every contingency seems to be provided for. If by any possibility the device fails to place the sheet properly, or fails to feed, the press instantly stops. If two sheets in the pile are by any means tucked or folded together, or if two sheets are lifted, the press stops. All inaccuracy of feeding, or the running through of doubles or "packets," is prevented, and much spoiled work obviated. The first move or slide of the upper sheet of the pile is given by a rubber-faced presser, no air suction being used. The apparatus is suited to nearly all presses, and is quickly adjustable to sheets of various sizes.

When we consider that there are some thirty thousand power printing presses now worked in the United States, to which this improvement is applicable, its importance becomes in some degree apparent. It is believed that the invention will save its cost in less than a year by its diminution of spoiled sheets, to say nothing of its saving in the wages of feeders. It is applicable to steam, lithographic, and other presses used in color printing, and it will greatly reduce the cost of producing fine chromo pictures, some of which are required to be fed through the press from twelve to twenty times, a separate impression being necessary for each shade or print of color. Mr. C. E. Baker, the superintendent of the *Independent* press rooms, 21 Rose street, New York city, will furnish additional information concerning this invention.

PATENTED CAR IMPROVEMENTS.

Two or three years ago the Master Car Builders' Association adopted, as a plank in their constitution, the brilliant idea of excluding from discussion all mention of patented devices concerning railways. If any man patented a car that could be built equally as strong as the present cars for half the money, or if he should invent and patent a truck that would not leave the track, and thereby greatly improve the safety of cars, preventing loss of life and property, he was forbidden to explain its merits before the Association, and that enlightened body could not, officially, take any cognizance of the new discovery.

There is no mistake about it that the discussions of the Master Car Builders, composed, as they are, of practical, wide-awake men, are of great importance in imparting and circulating sound, valuable information about the needs and merits of railway vehicles. We doubt whether there is a more able body of practical workers associated together in any of the various branches of American industry than these same car builders; and how they could ever have permitted such a streak of narrow-mindedness as this anti-patent declaration to creep into their constitution is to us quite unaccountable. At the late session of the Association, one of the members, in discussing the merits of various car roofs, was taken to task because he had spoken well of somebody's patented roof. But it was alleged in reply that, if the Association had done wrong heretofore in such matters, it was time that correction should now be made, for it was demonstrated that, in order to make progress, the Association must, of necessity, investigate patented improvements, and adopt those that are best. This is a sensible conclusion, and one that almost any old lady would have come to without waiting three years, or stirring up bile in the family.

THE MINES AND MINERALS OF INDIA.

For ages unnumbered, India has been famous for wealth in precious stones. Our geographies still speak of it as a land of gold and diamonds; and the popular idea is that its mineral resources are immense and inexhaustible.

So much for current fame. The facts of the case, as developed by the labors of the government geologists, show a very different state of things. The greater part of the vast area of the Indian Peninsula is either destitute of valuable minerals, or they occur in a manner which throws serious obstacles in the way of their utilization; while in the richer districts, the real mineral wealth lies not at all in the mines for which the country has been celebrated. The only diamond mines that pay or promise to pay for working are of the "dusty" variety, more useful for fuel than for ornament; and its precious ores are chiefly those of iron, as yet but little developed.

Copper occurs in many parts, and is mined in several places among the Himalayas, especially in Kamaon, Gurhwal, Nepal, and Sikkim. The mines are worked by natives, and the product is so inconsiderable that, even where the mines are most abundant—in Kamaon,—it is insufficient to supply the local demand. In the alluvial plains of Northern India, the copper-bearing points are few and the yield insignificant. In the metamorphic areas of the eastern and southern parts of the peninsula, where metallic ores occur but sparingly, the principal points, at which copper mines have been worked by the natives at various periods, are in Rajputana, the countries southwest of Bengal, and in the Presidency of Madras. At present the only works regularly carried on are near Jaipur, in Rajputana. Ancient workings abound near Chaibassa, in Bengal, where an extraordinary series of deposits occur, partly in lodes, partly disseminated through schists, and extending for a distance of eighty miles. Much fine ore still remains here, chiefly carbonate and red oxide of copper, with copper glance occasionally; but attempts to re-establish the workings by European miners have never proved successful.

Lead is less abundant than copper, with which it is commonly associated. Rich veins of galena are said to occur in Kulu, in the Northwestern Himalayas, and more sparingly in Gurhwal and Sirmur, but little has been done toward developing them.

Tin has been reported from two to three localities in the plains of India proper, but nothing is accurately known of its occurrence. Rich tin deposits are believed to exist among the mountains between British India and Siam, the same range which affords the well known stream deposits of Malacca, farther south: but the inaccessible character of the country has hitherto prevented any attempts to work them.

Silver is said to occur with the galena in Kulu, and with certain copper ores in Deogurh, but the quantity is small. The Deputy Superintendent of the Geographical Survey visited the latter place, but could find no evidence of a vein or other regular deposit of the ore. Gold is found in many parts, but always in very small quantities, in stream gravels. It is extracted by rude processes of washing, and the yield is so small that none but the poorest of the natives engage in the search, and these only in the spring, when agricultural work is suspended.

Small quantities of an ore of cobalt are found near Jaipur, in Rajputana, and are used for the coloring of enamels. Antimony occurs in Kulu and Lahaul, and zinc at Jawad in Mewar. Chromic iron ore is found near Salem, in the Madras Presidency.

Considering the immense area of India, its share of the more precious metals must be rated as extremely small. Nor is it probable that future discoveries will greatly increase its resources in this respect. For thousands of years the country has been thickly populated by natives familiar with at least the rude processes of mining and metallurgy; and as the remains of extinct and in many cases extensive workings abundantly testify, the country has been thoroughly explored. Besides, with the abundance of labor at the absolute control of the rulers, it has been possible to work mines, especially for gold and precious stones, which would not pay expenses with hired labor. Even the diamond workings, which helped to supply the ancient rulers with their stores of gems, were very likely carried on at a cost of labor which, if paid for, would greatly exceed the value of the proceeds.

The diamond-bearing districts are chiefly in the country around Karnul, Kuddapah, and Ellore, in the Madras Presidency, near Sambhulpar on the Mahanadi; at Weiragad southwest of Nagpur, and at Panna, in Bandelkhand. Of late years comparatively few diamonds are found, and the few attempts that have been made to reopen the mines have proved unprofitable.

Of rubies, sapphires, and other precious stones, India is quite destitute, though they are found in Ceylon, Independent Burma, and in the countries northwest of the Himalayas. The best that India can offer for jewelry are agates, cornelians, and other forms of quartz derived from the trap rocks of the central and western portions. Corundum occurs in Mysore and Salem, also in Rewah, where there is a bed several yards in thickness, associated with jade.

Infinitely more valuable than the gold and gems of the past are the salt beds of the present. The deposits of this homely yet necessary substance in the salt range of the Punjab furnish upwards of fifteen hundred millions of dollars a year to the revenue of the government. The deposits are practically inexhaustible, and for extent and purity have no known rival. The prevalent color is white, sometimes tinted pink or reddish, the mines forming crystaline grottos of indescribable beauty. Another kind of salt is found in great quantities in the Trans-Indus county of Afganistan, occuring in masses in the beds of ravines; and though less white than that of the Punjab, is considered more savory.

More important than the salt mines are the extensive deposits of coal. So far as explored, the coal fields of India are chiefly comprised in a tract of country stretching from the neighborhood of Calcutta, and from a line roughly parallel with the coast of the Bay of Bengal and distant from it between one hundred and one hundred and fifty miles, to about the 78th parallel of east longitude. On the north it is bordered by the plain of the Ganges, and on the south it extends locally a little beyond the Godavari. Outside of this area, the only coalfields of promise are those of Upper Assam. The geological age of these coals, long in dispute, has now been clearly ascertained to be that of the Australian coal, differing little if at all from the carboniferous of Europe. A few deposits of lignite occur in the Punjab, but they are small in quantity and inferior in quality.

Geographically the coal fields of India are roughly divided into four groups: 1. Those of Bengal, including the coals of the Rajmahal Hills and those of the valley of the Damuda 2. Those of Rewab, Sirguja, Bilaspur, Chutia, Nagpur, and the tributary mehals of Orissa. 3. Those of the Nerbudda valley and the hills to the south of it. 4. Those of Chanda and the Godavari.

The principal field is that of Raniganj, beginning about 120 miles northwest of Calcutta, and extending northward about eighteen miles, with an extreme breadth of fourteen miles. This field supplies about half a million tuns a year, ten times the yield of all the other fields together. The seams which are mined vary in thickness from 4½ to 35 feet, and are individually variable. Eighteen distinct coal-bearing areas are enumerated in the several groups, but the most of them are so little explored that no trustworthy estimate can be made of their contents. In all the basins the coals are mostly concentrated in one bed of great thickness, consisting of alternations of coal and shale, and the beds thin out rapidly to the west. In the Raniganj field, where the formation attains its maximum thickness, the upper group is 5,000 feet thick, the lower 2,000, each containing several seams of coal. To the west the upper group is replaced by rocks containing no coal, while the lower diminishes greatly in thickness.

Scarcely anything is known of the Upper Assam fields save that there are several seams and the coal is of excellent quality, containing only two to five per cent of ash. Unfortunately these deposits are almost at the extreme east end of the Assam valley, in a country thinly inhabited and hard to be got at. Some of these coals are said to coke while burning; but with this exception, the Indian coals are all free burning and will not form coke. Generally, too, they are very lean, containing from ten to thirty per cent of ash. For mechanical purposes, they are little more than half as valuable as English coals, and are consequently unfit for use in sea going vessels, owing to the great bulk and the labor of handling. Unless they can be made available for smelting purposes, especially for iron, the demand for them will be restricted almost entirely to railway use, river steamers and stationary engines. It is hoped, however, that with proper selection and care they may be made available in the manufacture of iron; in which case the greatest possible impulse will be given to coal mining, and there is reason to believe the immediate future will bring to India an iron age of productive wealth compared with which the barbaric splendor of the past will be as nothing.

Unlike the ores of the rarer metals, those of iron are widely and generously distributed throughout India, some of the deposits being unsurpassed in quality and abundance. The more valuable of these deposits are of magnetic and specular ores and red hematite, in beds or veins among metamorphic sub crystaline rocks; for size and character, they remind one of the iron mountains of Missouri. There are, besides, clay iron ores in the coal-bearing strata and beds of brown hematite in other stratified rocks; also surface deposits of magnetic iron sand, and nodules of brown hematite, which supply the ores chiefly used by the native smelters.

The most remarkable deposits are near Salem, in the Madras Presidency. They consist of immense beds, from fifty to a hundred feet or more in thickness, the outcrop extending frequently for miles. One of these forms the ridge of a hill 1,500 feet high and four miles long. Another hill of equal length, not far distant, contains five bands of magnetic ore, from twenty to fifty feet thick, which can be traced all round the hill. These are but two instances out of many that might be cited from this locality. At Lohara, in the Central Provinces, a hill two miles long and half a mile wide appears to consist entirely of specular and magnetic ore which yields 70 per cent of metallic iron.

The deposits of hematite, though on a less imposing scale, are often of great extent and richness. The clay iron ores are similar to those of the English coal fields, and the quantity large. A great number of specimens from the Raniganj field yielded on assay an average of 39 per cent of iron. Thus far the few attempts to manufacture iron in India on a large scale have, for various causes, resulted in failure. There is no reason to doubt, however, that the difficulties will be overcome, and these vast beds of iron ore be made the sources of immense industrial activity and wealth.

The Next Fair of the American Institute.

We have received the usual pamphlet containing the announcement of the 43d fair of the American Institute. The exhibition will be held in the same building as last years' on Third avenue between 63d and 64th streets in this city, and opens, for the reception of machinery, August 17, 1874. Goods will be received from the 31st of the same month, and the formal opening to the public takes place on the 9th of September. Unless it be deemed expedient to continue the fair an additional week, the 14th of November is designated as the closing day.

Some changes have been made in the classification of entries, and the number of awards has been increased to nine. They now consist of gold medals of honor and progress, a medal for taste, a silver medal, a bronze medal, diploma, and special diplomas for continued superiority and excellence and for coöperation.

We would remind intending exhibitors of the necessity of early preparation. There is plenty of time afforded, to have everything in readiness before the fair opens, and so to avoid the confusion which usually occurs during the opening week.

Cincinnati Industrial Exposition.

The success of the expositions held annually in Cincinnati for the past four years has justified the managers in enlarging their space and extending the field of operations. The very elaborate circular now before us contains over 900 premiums to be awarded for excellence in all departments of manufactures, domestic industry, agriculture, science, and art. Although the space at the disposal of the management is very large, it is desirable that early application be made for allotments, as the wish to exhibit at these expositions becomes more and more extended. The buildings will be open for the reception of goods from August 3 to September 1 and the exposition will open to the public on September 2 and will remain open till October 3. Applications for information and documents must be addressed to W. P. Anderson, Secretary, Cincinnati, O.

POWDERED chalk, added to common glue, strengthens it A glue which will resist the action of water is made by boiling one pound of glue in two quarts skimmed milk.

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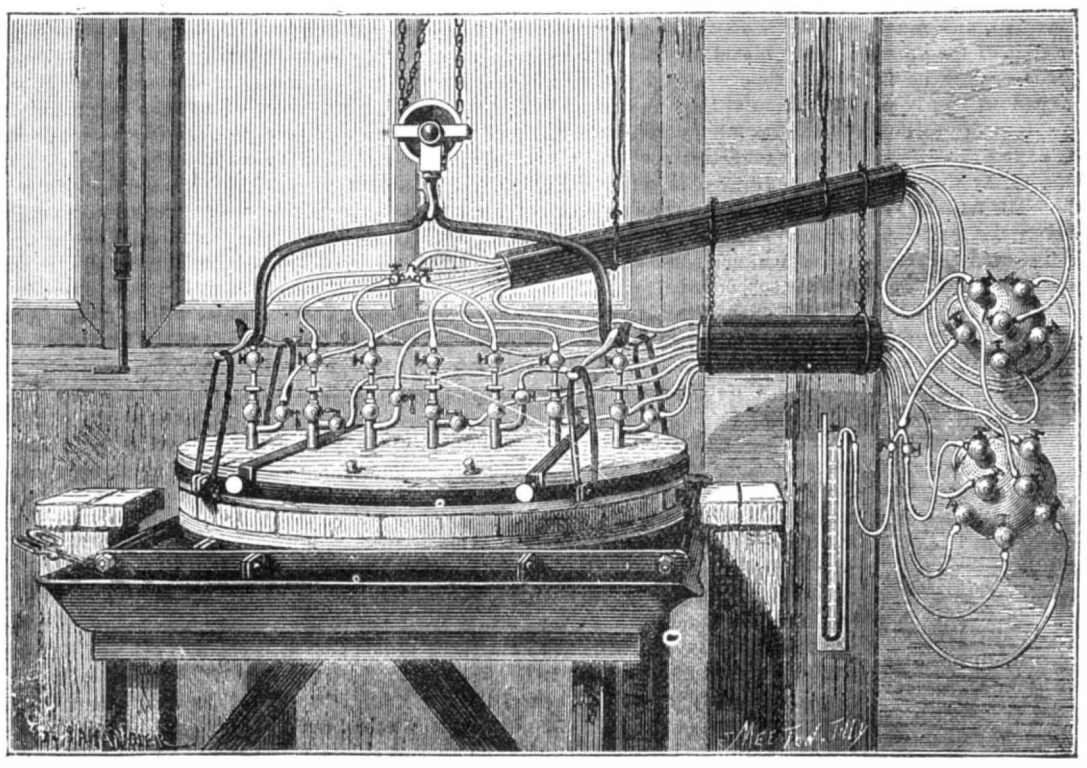
CASTING THE STANDARD METER.

Some time ago we gave a brief account of the labors of the International Metrical Commission in Paris, with regard to the determination of the exact length, properties, etc., of the standards to be used as the basis of the metrical system of weights and measures, in nearly all the countries of the globe. The metals fixed upon for the alloy were iridium and platinum; and about a year ago, the former component in its proper proportion, some 55 pounds, was prepared in the laboratory of M. St. Claire Deville.

Quite recently the ingot from which the standards are to be made was cast, the utmost care being taken to secure a perfectly homogeneous alloy. The platinum together with the iridium was melted in quantities of 22 pounds. The ingots thus formed were cooled, cut in pieces, and again melted, 176 pounds at a time. These masses were again cooled and once more cut up and finally run into a single block. The work was done at the *Conservatoire des Arts et Métiers* in Paris, and occupied two hours.

We give herewith an engraving, extracted from *La Nature*, showing the furnace used. The apparatus is the largest of the kind ever constructed, and it has served to prove that the liquefaction, by heat, of great masses of platinum is no longer an obstacle to Science. The lump of metal, when inserted, measured 44·8 inches long by 6·6 inches broad, and 3·1 inches thick. Its value was $50,000, and it was the largest quantity of platinum ever melted at a single time.



FURNACE FOR MELTING PLATINUM.

The crucible was made of Saint Waast stone, a large grained calcareous material, containing about five per cent of silex, and lightly pulverulent. When the platinum was melted, in a cavity hollowed in the stone, the carbonic acid (due to the heating of the mineral) only became disengaged on the edges of the liquid mass, and did not bubble up through the same. The decomposition of the limestone took place through a depth of about 0·6 of an inch, so that the metal rested on a bed of lime of quite considerable thickness.

At each extremity of the crucible were openings through which the platinum, cut up as we have above described, was passed. As soon as the seven oxyhydrogen burners were lit, the fusion began with great rapidity. Through openings left for the purpose, the aspect of the melted metal could be observed. It appeared of a brilliant silver white, as fluid as mercury, and having a mirror-like surface. Large and very brilliant flames also burst forth from the side orifices of the crucible. The temperature of the mass was about 4,172° Fah.

The numerous small tubes shown in the engraving serve to lead the gases to the burners, and each set springs from a copper sphere. The consumption of oxygen was about 3,327 cubic inches to a pound of platinum. During the melting, the ignited products arising from the vessel were carefully examined by means of the spectroscope. Some traces of palladium, it is said, still exist in the alloy. It is stated that, in preparing the iridium, enough osmium was obtained to make 22 lbs of osmic acid, one of the most deadly poisons known. The above quantity, M. Deville said, in addressing the French Academy, was enough to kill every person in the world. The block, after being rolled to 77 times its present length, will be cut into rectangular bars and formed to the proper standards by accurate mathematical measurements.

THE CLAMOND THERMO-ELECTRIC BATTERY.

In 1821, Professor Seebeck, of Berlin, discovered that by soldering together a bar of bismuth and a bar of copper, and applying heat to the junction, an electric current was generated of sufficient intensity to be plainly indicated by the galvanometer needle. To this current and couple, he gave the name of thermo-electric, in order to distinguish them from the hydro-electric or ordinary current and couple. The thermo-electric current is ascribed by Becquèrel to the unequal propagation of heat in the different parts of the circuit, since, when all the portions of the latter are homogeneous, no current is produced on heating, because the heat is equally propagated in all directions. As compared with the hydro-electric current, the electro-motive force is very small, producing but feeble chemical action.

It is unnecessary to enter into the details of past investigation into this subject, since a reference to any standard work on physics will afford all necessary information. The principal application of thermo-electricity is to be found in the thermo-electric battery, which accumulates the tensions produced, in a circuit composed of several metals, when the alternate solderings are heated, the others being kept at constant temperature. This battery, in the form of Nobili's pile, employed in connection with a galvanometer, is used in Melloni's thermo-multiplier for measuring temperature, the the slightest differences in which it indicates with unfailing accuracy. Those of our readers familiar with Tyndall's work "Heat as a Mode of Motion" will remember that the thermo-electric battery was the thermometer used in the entire course of brilliant experiments described in that volume.

Save for purposes of demonstration, the thermo-electric pile has been of little practical value. It has played no part in industrial operations, though attempts thus to utilize the current have not been wanting. Farmer exhibited two models at the French Exposition of 1867, of ingenious construction, but they lost their power rapidly, and the bars, being excessively fragile, broke in cooling. In 1869, Becquerel presented to the French Academy a battery constructed by MM. Clamond and Mure, of couples of galena and iron plates, in which, however, the current gradually weakened because of the augmentation in the resistance of the apparatus. As this invention formed the basis on which the remarkable device which we are about to describe is founded, it may be well to notice more carefully its defects and the means taken to cure them. The difficulties lay, first, in the oxidation of the contact of the polar plates with the crystalized bar under the influence of heat. Second, in the splitting of the bar of galena and its separation into different portions in planes perpendicular to its length. The result of M. Clamond's efforts to overcome that was the battery represented in our engraving—in perspective, Fig. 1, section, Fig. 2, and plan, Fig. 3. In order to get rid of the first trouble, he altered the mode of attachment of the iron plate, bending it back on itself irregularly so as to present many re-entering angles. These are made to envelope the bar so that as the latter heated it expanded more than the surrounding metal, and so forced itself all the tighter into the angles. This disposition will be understood from Fig. 3, in which B B are the bars, and L L the plates. The second difficulty offered greater obstacles, as it had been found that, when a thermo-electric body, either metal or metallic sulphide, is cast in a cold cubical mold, splitting ensues, parallel to the faces of the cube. These divisions become visible after heating, and are supposed to be due to the extreme fragility of the body and its crystalization against the surfaces of the mold. In order to prevent the splitting, M. Clamond heated his molds to temperatures nearly equal to the fusing point of the thermo-electric substance, and employed couples made of an alloy of zinc and antimony (in lieu of galena) and his iron plate as before. This alloy he adopted on account of its good electrical conductivity, and because the temperature of its melting point rendered his method of casting easier. Iron he used in preference to copper or argentar, because it resists the effects of the alloy more effectually.

Fig. 1.

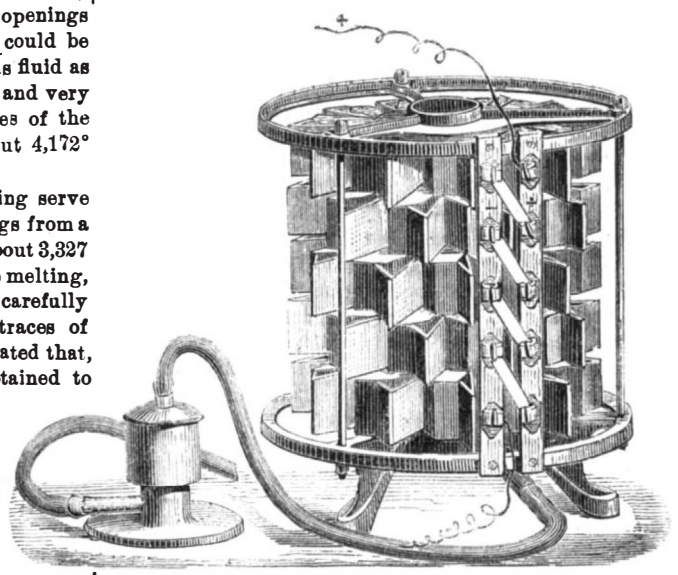
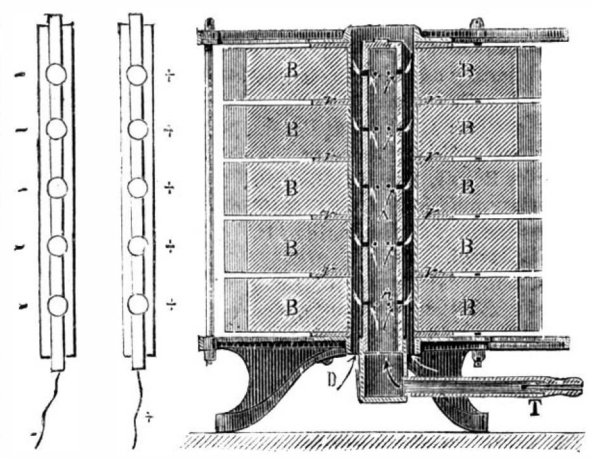


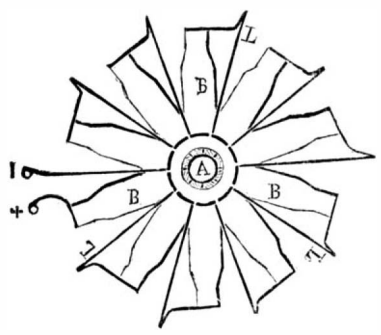
Fig. 2.



The bars of alloy, as shown in our engravings, for which we are indebted to *La Nature*, are assembled in crowns and coupled for tension. These crowns are each composed of ten bars, B, Fig. 2, superposed and separated by collars of asbestos. The apparatus forms a cylinder, the interior of which is lined with asbestos and heated by means of a pipe, A, of refracting clay, pierced with holes. The gas entering at T escapes through these orifices and mingling with air, which comes in at D, burns in the annular space between the tube and bars. The extremities of each crown are held in clamps of copper fixed in two standards, shown separately at the left of Fig. 2, and at the front of the apparatus in Fig. 1. The crowns may be coupled for tension or for surface, the latter for each crown being 7 square feet, or 35 square feet for the entire battery.

The Gerond regulator is used to render the flow of gas uniform; and thus arranged, the battery works for months without requiring the slightest attention. The apparatus exhibited before the French Academy of Sciences uses one cent's worth of gas per hour to deposit 308 grains of copper in similar time. So that for fifty cents 2·2 pounds of the metal may be deposited. The quantity of electricity augments in proportion to the size of the bars, which are made of different dimensions, varying from half an ounce to nine pounds. Experiment also shows that, with an equal number of couples, the weights of copper deposited are proportional to the weight of the couples.

Fig. 3.



The battery, we understand, is now being used in the printing office of the Bank of France, and in the large photo-engraving establishment of Goupil, at Asniéres, giving remarkably successful results.

Epsom Salts and Sulphurous Acid in Dyeing.

It has been long remarked that woolen goods dyed with aniline colors, and treated with Epsom salts, will stand the action of soap and soda, and the dressing process generally, better than when not so treated, or than when treated with any other substance.

Dr. Reimann advises the use of Epsom salt on yarns to be dyed violet. By the action of soda, the magnesian salt is decomposed, with separation of insoluble magnesian compounds, which exert no action upon the coloring matter; any alteration in color by the alkali is thus prevented.

All woolen dyers are agreed that, in dyeing with methyl- and dahlia-violet, the use of sulphurous acid is very advantageous. The colors are thus obtained of a brighter, clearer tint.

It may be that, a partial reduction of the methyl-rosaniline to leucaniline having taken place, oxidation then effects the transformation of the latter into the former.—*Dingler.*

A NEW life-saving invention has recently appeared in Paris in the shape of a durable garment which covers the entire body. It is made of rubber, and is provided with a flexible tube which has a mouthpiece. By blowing into the latter, the person in danger inflates the garment, which buoys him up when in the water.

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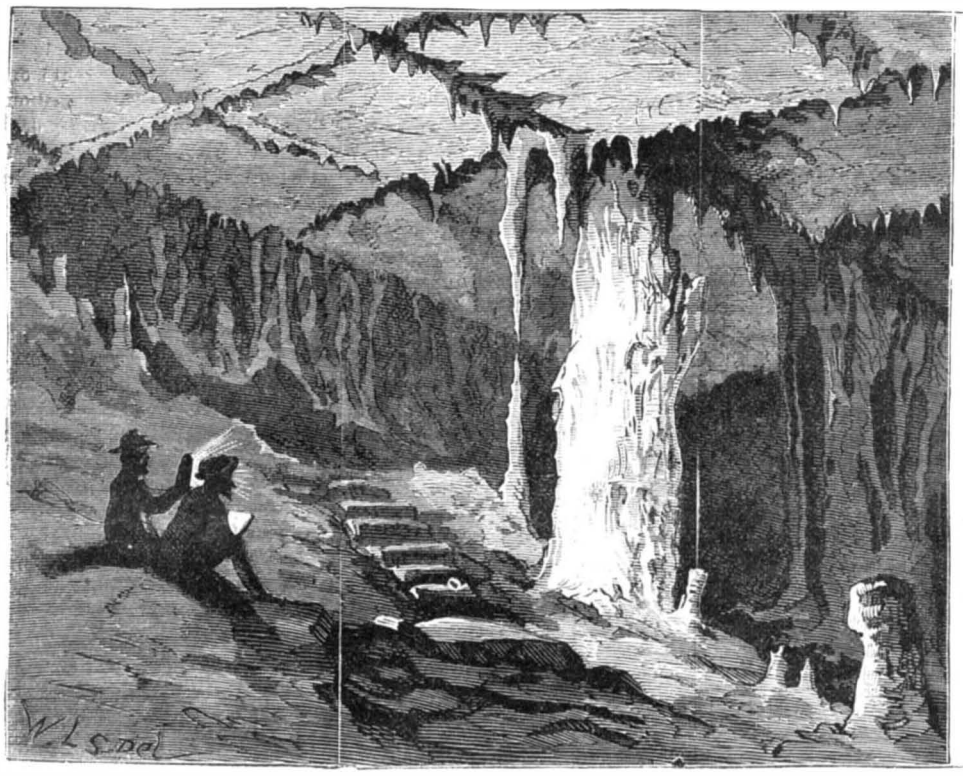
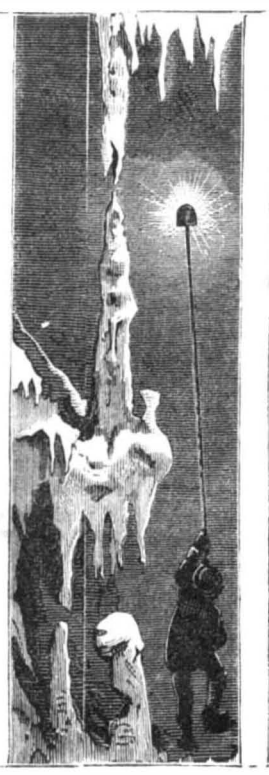
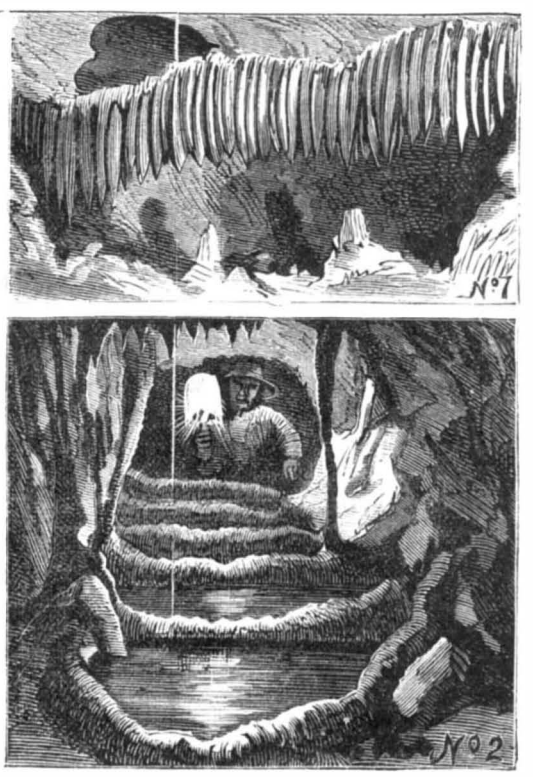


PANELED HALL, NEAR THE ENTRANCE.



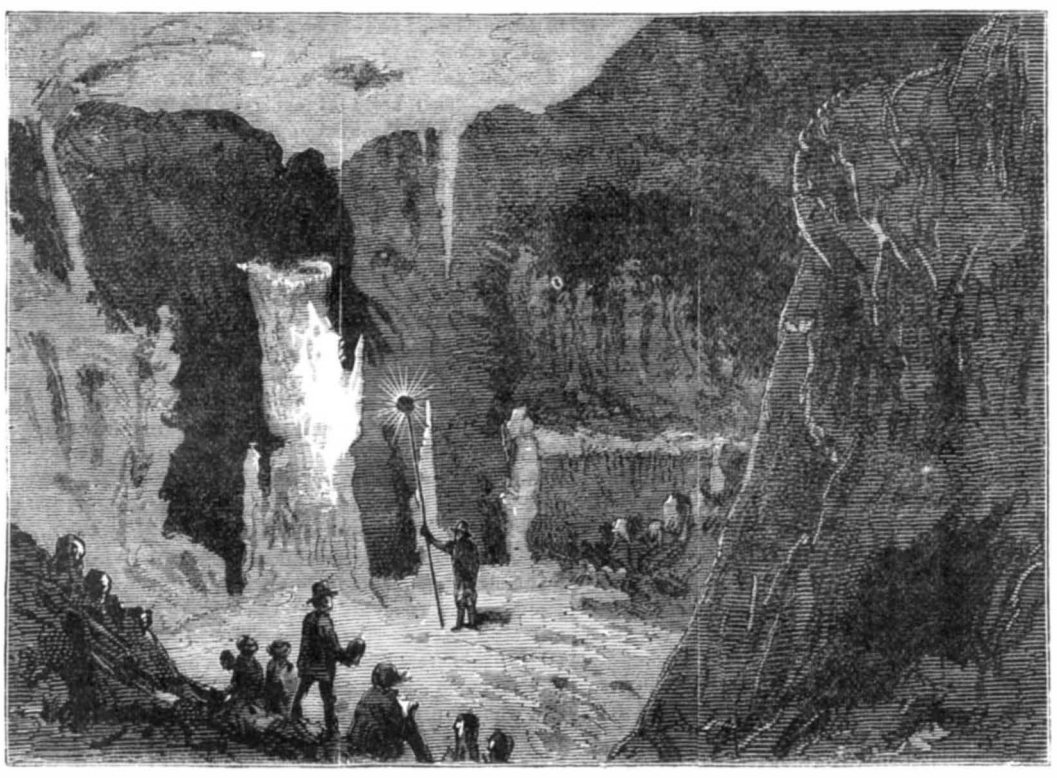
SINGULAR FORMATIONS.



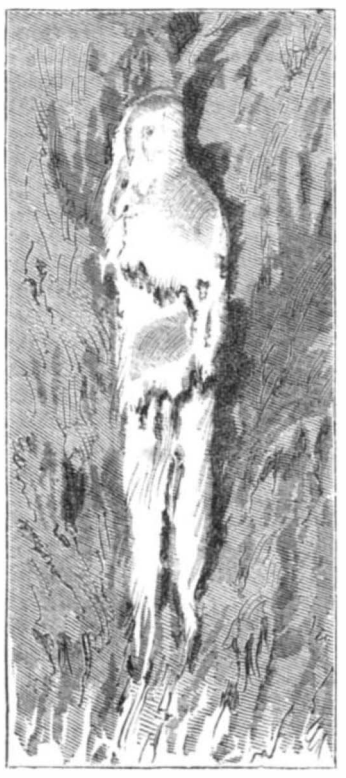
No. 1.—JEFFERSON'S TOBACCO BARN. No. 2.—ELF'S BATH.

HALL WITH THE WHITE PILLAR.

ARCHED PASSAGE BETWEEN THE TWO HALLS



LARGE HALL, NEAR THE END OF THE CAVE.



THE HANGING MAN.

POMPEY'S STATUE.

VIEWS IN FOUNTAIN CAVE, VIRGINIA.

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FOUNTAIN CAVE, VIRGINIA.

Though of much less extent than the Mammoth, Weyers, or other great caves which rank among the chief natural curiosities of the United States, Fountain Cave, in Augusta county, West Virginia, is remarkable for many singular as well as beautiful formations, interesting alike to the student of geology and the tourist for pleasure. We give on another page a series of illustrations, engraved from sketches made of the most prominent features, from which a most excellent idea may be gained regarding the curious freaks of Nature within the recesses of the cavern. Many of the most delicate and fascinating attractions are not of a character to be adequately represented, so that the sparkle of the incrustations and the myriad and ever changing forms of the stalactites and stalagmites must necessarily be left to be supplied by the imagination of the reader.

One of the most striking portions of the interior is "Panel Hall," peculiar both for its size as well as for the odd markings on its walls and roof, caused by the drippings from the rock. "Jefferson's Tobacco Barn" derives its name from a singular row of stalactites which resemble tobacco hung across a pole to dry. The "Tannery" has formations, the size of the largest side of leather, depending from the roof. "The Hanging Man" is a stalactite nearly seven feet long and located some ten feet above the floor, which, as will be seen from the illustration, looks very much like a suspended human body. "Pompey's Statue," a beautiful white formation about two feet in hight, on a pedestal twelve feet high, bears a striking resemblance, when the light is held in the proper position, to a figure in helmet and antique dress. The group of stalactites and stalagmites given in one of the smaller cuts, is about thirty feet in total hight and very beautifully marked. "The Elf's Bath" is a picturesque series of basins filled with pure sparkling water, in which it is easy to imagine that the elves or the gnomes which we read of in fairy lore may choose to disport.

Although the existence of the cave had been suspected for several years, it was not discovered until four years ago. It is located seventeen miles northeast of Staunton, on the Chesapeake and Ohio Railroad. Access to its interior has been made quite easy, and explorations may be conducted to a long distance from the mouth.

Correspondence.

The Transmission of Sound.

To the Editor of the Scientific American:

On page 177 of your journal is an account of the investigations of Professor Tyndall respecting the transmission of sound, and the varying distances at which the same sound can be heard. I have a theory that differs from his, which at the same time, I think, accounts for all the phenomena therein stated.

It is known that atmospheric air can hold a considerable quantity of watery vapor in suspension; but the amount depends directly on the temperature. For example, at a temperature of 30°, air will contain 2·2 grains of water per cubic foot without being saturated. At a temperature of 90° it will require 14·5 grains per cubic foot to bring it to the point of saturation, or dew point. It has been observed that, when the atmosphere is saturated with vapor and about to deposit dew, sounds can be heard at a great distance; whereas when it is devoid of moisture or far removed from the dew point, sounds can be heard but short distances; in other words, the ability of the atmosphere to transmit sounds is directly as its proximity to the point of saturation. The following case will illustrate: On a certain occasion the puffing or exhaust steam of a locomotive, in starting a train, was heard distinctly six miles. This occurred in the winter season and on a day when there was neither wind nor sun, and I am certain the atmosphere was near the point of saturation, for it was a dark, hazy morning, just before a misty rain storm. A few days subsequently, the same sound, over the same course, was entirely inaudible at a distance of three quarters of a mile. This, too, was on a cold, cloudy, still day, and the atmosphere must have been devoid of moisture, as it was a day in which electrical action could be readily excited by stroking the hair with a comb, or a garment with the hand; and it is well known that, in order to excite electrical action, there must be an entire absence of moisture.

This readily accounts for the phenomena of Professor Tyndall. He states that, on a hazy day, his fog horn could be heard twelve miles dead to windward, whereas on a clear, warm, sunshiny day, neither horn nor gun could be heard two miles. On the former day, it is evident the atmosphere was near the point of saturation; but on the latter day, the sun was shining hot. This would raise the temperature of the air and remove it from the point of saturation, as it requires a greater amount of water to saturate it at the high temperature. "But," he adds, "a cloud obscuring the sun, the sound began to be audible and became louder and louder till sundown, when it had increased fortyfold." It is evident that as the sun became obscured, the atmosphere began to cool, and therefore came nearer the dew point, and in that proportion the sound became more audible.

This theory can be verified by many ordinary observations. For example, it is known that sounds can be heard more readily at night than in the day time; and it is likewise known that the atmosphere is then nearer the dew point. It is also regarded by many that the hearing of sounds a great distance, as the running of trains, is a sign of an approaching storm, and this is only an indication that the atmosphere is becoming saturated with moisture. Violinists are also aware that, when electrical action can be excited, as by stroking the fur of animals, their instruments lack power; and that is only an indication that the atmosphere is devoid of moisture.

Respecting the theory of Professor Osborne Reynolds that sound is refracted or bent upward under certain conditions, it does not follow that such is the case, because sound is heard more distinctly from an elevated location than from one near the earth. If the observer be in an elevated place, besides the amount of sound passing directly to him, the earth would reflect a large additional volume. That could not be the case if the observer were near the earth, as the reflected sound would be intercepted by objects near the earth. Besides, if sound is refracted similarly to light, by certain varying temperatures, etc., why should light be refracted or bent downward, enabling us to see the sun before it has arisen and sound be, bent upward, as it would seem that similar causes should produce similar effects in both cases?

Professor Osborne Reynolds seems to have pretty clearly demonstrated that sounds can be more readily heard from an elevation than near the ground, and infers that the sound is bent upwards. But suppose, in the place of the sounding body, a loaded shell be placed and exploded. An observer in an elevated position would be much more likely to receive injury than one on the ground, not because the course of the fragments of the shell is bent upward as they radiate from the point of explosion, but because the force of the explosion seems to be directed more upward than horizontally, on account of the reactionary force of the earth.

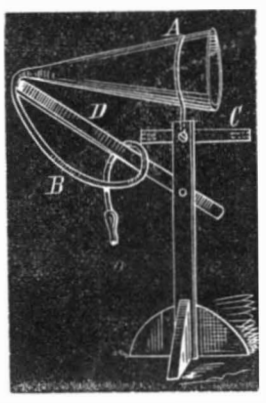
Bridgeport, Conn. F. G. FOWLER.

A Simple Ear Trumpet.

To the Editor of the Scientific American:

I am afflicted with deafness, so that I cannot hear a conversation carried on in an ordinary tone of voice. In order to assist my hearing, I have constructed an apparatus which enables ordinarily deaf persons to hear a lecture or a sermon, or to enjoy a theatrical performance.

The horn is made of paper (two thicknesses) with some ornamental paper covering the exterior and interior. It is shaped over a confectioner's "pyramid mold," of the hight of 18 or 20 inches, and width, at the large end, of about 15 or 16 inches.



At A, it is surrounded by a strong brass wire, of which one end is inserted into the upper end of the stand, which has a hole bored in it sufficiently large for the wire to act like a pivot. A flexible tube, B, of any desirable size, is attached to the small end of the horn, and ends in a mouthpiece of horn or gutta percha, connected with the ear. C is a cross piece with holes bored into each end which enables one, by turning, to elevate the horn, and D acts as a supporter and also as an elevator if desirable. The rest explains itself. As this simple device is probably not patentable, I give it to those unfortunates who are similarly afflicted.

Sacramento, Cal. JOHN EITEL.

The Spiral Theory of Physical Phenomena.

To the Editor of the Scientific American:

I once saw a juggler take a long cord, fastened at its further end a few feet above the floor, and by quick movements of the other end in his hand produce the appearance of a revolving spiral, having a pitch and diameter which varied at the will of the mover. I then thought and said: That suggests an explanation of the wave theory of sound and light.

Just now, in looking over Chambers' *Encyclopædia*, I came upon the article on sound, and was startled by the appearance of a diagram of the above described movement in explanation of the wave theory, but my eager search for an intimation of my screw theory was unrewarded; and I came home to copy the above description, and the following outline from a manuscript written a few months ago (although I have a sketch of the theory written in February, 1872); and I now present the idea for consideration and, as I confidently anticipate, verification.

Briefly, my suppositions are (1) that the ultimate ether molecules have a constant rotation upon their axes, with polarity; (2) that the intermolecular spaces contain the elastic magnetic fluid; (3) that any disturbance of their equilibrium occasions rather an accelerated axial rotation of the molecules with decrease of temperature, or a retarded rotation with increase of temperature; (4) that any change of initial molecular velocities is accompanied by a progressive rotation at right angles to the plane of the disturbing impulse; (5) that the actual progression is limited to the vicinity of the impulse, while the apparent progression continues until obstructed; (6) that the velocity of the helical revolutions, or progressions, is determined by the impulse, and continues in the same time for the same impulse; (7) that all observed phenomena are manifestations of personal presence and character in effecting the action and interaction of the fluid and the molecules, with and upon the cosmic dust. If hydrogen gas is a metal in particles, there can hardly be any particular objection to the word "dust" as generally descriptive of cosmic substances, in distinction from the ether and the fluid.

The formulated suppositions are, as you will observe, partly adopted and partly speculative, the theory arising in the described manner several years ago; from that time to this, my desultory reading and observation have often appeared strikingly to confirm my conjecture; and just now, as I read your articles of June 13 on "The New Theory of Quantivalence," and "Refraction of Sound," I for the hundredth time thought "my spiral theory makes these points clear; strange that some one does not see it!" When Mr. Proctor was lecturing in this city, I hastily put together these formula to bring them under his notice through one of our daily papers, but the editor was suddenly called out of town that morning, and the article slumbered in his drawer several days past the time when I wished it to appear. I reproduce it mainly now, and wish you to notice the coincidence between parts of it and the closing paragraph of your article on quantivalence.

In view of my inexperience as an experimenter, and want of knowledge as an investigator, I may appear presumptuous in my suppositions, but I fall back upon my inherited Yankee right to guess, even to the degree of thinking that physical facts generally will be found in accordance with the formula; while I venture particularly to suggest, for instance, that the string of a musical instrument does not vibrate, but does gyrate, and that the sound is due the given velocity of rotating helices of proper sized ether molecules in appropriate polar relations to the dust, suspended at a suitable temperature in the magnetic fluid. Reed, pipe, and vocal sounds are likewise gyratory, and are perhaps produced as water is twisted by angle of exit and friction on leaving the hydrant faucet; for example, in a flute, the high tones result from entrance at a proper angle, high velocity, small friction, and exit at a fine pitch of spiral, while the lower tones have different angles, lower velocities, greater friction and exit at a coarser pitch of screw; the trombone may be similarly explained, the "mouthing" consisting in giving the right twist and size to the rope of air.

Put a bright iron screw in rapid revolution, and you will have a striking illustration of the apparent movement of light in waves and emissions, light thus arising from a change in the velocities and other enumerated conditions of the molecules, and of the fluid and dust; and the phenomena of reflection, refraction, and polarization of light will soon find clear explanations on the spiral theory.

The solar spectrum with its Fraunhofer lines may thus be said to be an untwisting of the ray thread to show its colored strands, which also, being untwisted, throw out the entangled dust which casts its shadow lines across the field.

The electric current will also be found a helicoid, and the bare statement of this proposition is startling in its suggestion of many well known analogies which send in spiral thrills of quick succeeding sense, and the pleasing thought that now at last we have the clue long sought.

Whirlwinds and waterspouts need only to be mentioned to bring at once the thought of spirals, grand and awful, and waves may readily appear before the mind as formed by nearly horizontal screws, whose pitch, diameter, and speed decide if ripples, billows, or great water hills shall in procession move.

This given theory embraces the small and great, the general and particular, the seen and unseen; therefore it may be humbly anticipated that the displayed cross section of a cord of light would afford a clear illustration of all aerolites, asteroids, satellites, planets, suns, and stars, as viewed from the axis of the rotating helicoid Universe.

W. STORER HOW.

Foul Wells.

To the Editor of the Scientific American:

My well, though yielding in general very good water, will occasionally get foul both to taste and smell. I suppose all wells are liable to the same difficulty. Generally it results from some body, a potato or other vegetable, or (still worse) an animal substance, which has accidentally found its way into the water. But sometimes no cause is apparent. I use common wood charcoal, which I pound quite fine in a cloth bag and throw into the well—one or two quarts in quantity. But this, though efficient, and finally settling to the bottom, requires one or two days for the process, and will sometimes occasion inconvenience by choking up the valves of a pump connected with the well. If any of your readers practise a better method, I should be grateful for the information.

Being obliged to continue using the water in spite of its ill smell and taste, it occurred to me to boil it for five minutes. This I did at evening, boiling a bucketful for drinking the next day and allowing it to cool over night. The result was very satisfactory. The water was delicious—perfectly sweet and pleasant, even without ice.

Englewood, N. J. J. V. B.

The Growth of Timber.

To the Editor of the Scientific American:

I send you a small piece from my flagstaff, recently erected; before it was trimmed, its diameter was fourteen inches at the base, and its length sixty-six feet.

When you examine the closeness of its concentric rings 63 in three quarters of an inch, you will not be surprised to learn that it was 230 years growing, that is, that it was living in the time of Oliver Cromwell.

When we consider that the straight and tall growth of the pine depends on its being so crowded by other trees as to have all its foliage grow at the top, while the lower branches die for want of light and air, and that the ground room is insufficient to support roots enough for the growth of much top, we may conclude that the growth of the wood for a tall, straight tree must necessarily be very slow, and that many years are required to produce one of much thickness. If, then, such a small tree be two hundred and thirty years old, what must be the age of some used for large masts? Cannot some of your correspondents tell of some pine trees 500 or 1,000 years old? H. M. S.

[The concentric circles in the specimen are wonderfully regular and close.—EDS.]

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SCIENTIFIC AND PRACTICAL INFORMATION.

HOW TO KILL GRASSHOPPERS.

Reports of Western railway trains stopped by grasshoppers are apt to be taken by Eastern people as samples of Western humor rather than as statements of actual fact. Similar incredulity was manifested on the other side of the Atlantic, a few days ago, when a telegram came from Algiers telling of the delay of a train from Oran, six hours, for the same cause, namely, the accumulation of grasshoppers on the rails. But it was no joke. The grasshoppers are as great a pest there as they are in some parts of the Far West, and just now they threaten the utter destruction of the growing crops over considerable areas.

Many plans have been tried for their suppression, the most successful, according to a circular of instruction lately issued by General Chanzy to the generals of division and prefects of Algeria, being that employed in Cyprus. By this plan the attack is made neither on the eggs nor on the fully developed insect, as practised elsewhere, but during the intermediate or wingless period of their development, a stage beginning about a month after the eggs are hatched, and lasting three or four weeks, during which the "crickets" wander about in compact masses and are easily taken in V-shaped traps open to the line of march. The sides of the traps are made with strips of silk a hundred yards long and two or three feet wide firmly attached to poles set in the ground. The bottom edges of these walls of silk are banked with earth so that the crickets cannot crawl under them, and the upper edges are waxed or bordered with oiled silk, which prevents their climbing over. As they have no wings to escape with, they are forced to mass themselves at the apex of the system (as it is called) where they tumble into a trench edged with plates of zinc, which offers no foothold, so that they are effectually trapped. When the trench is full the insects are covered with earth, and the system is moved on to continue the work of destruction elsewhere. Upwards of 7,000 cubic yards of grasshoppers were thus destroyed in Cyprus in a single season. With the conversion of our Western plains into farm lands, it is becoming more and more necessary to combat the grasshopper plague on a grand scale. Our farmers will do well to profit by the experience of the East.

VANILLA FROM PINE TREES.

There has recently been submitted to the French Academy some small crystals which are the pure aromatic principle of vanilla. These, it is remarkable to note, were extracted from conifers. The cambrium of the latter contains a crystalized glucoside, coniferine, which MM. Tiemann and Haarmann consider represented by the formula $C^{16}H^{88}O^{18} + 2H^2O$. Submitted to the action of emulsion, the coniferine separates into glucose and a component crystalizing in fine prisms which melt at 163·4° Fah. The latter material is readily soluble in ether, less soluble in alcohol, and insoluble, or nearly so, in water. It contains C^{10} H^{18} O^3. Under the influence of oxidizing agents, the product of the fermentation undergoes a remarkable change. In warming it with a mixture of potassic bichromate and sulphuric acid, it disengages first ethylic aldehyde, and then an acid substance soluble in water, which may be separated by agitating with ether. By evaporating the latter, star-shaped crystals are obtained which melt at 177·8° Fah., and which are identical with the aromatic principle of vanilla. The formula is C^8 H^8 O^3, which corresponds exactly with that attributed to the aromatic extract of vanilla.

NOVEL IMPROVEMENTS IN STEAM BOILERS.

Mr. Charles H. Haswell, a well known engineer of this city, has recently patented a new steam boiler which presents many valuable points of advantage, and which appears to be well worthy of the examination of steam users generally.

It is hardly possible to enter into the details of the invention without the aid of illustrations. In the improved boiler, the principal features consist in inclined tubes, which extend transversely across the boiler and slope from the central flue down to the two side flues. By this arrangement, a transverse area required by the area of grate surface, the area of heating surface, and the volume of the steam chamber above can all be obtained without prejudice to the hight of the furnace below, and without involving an impracticable length of boiler. The tubes can also be readily removed and replaced, and the necessary work can be prosecuted within the boiler. A vertical diaphragm is introduced in the return flue, which serves to direct the products of combustion so as to admit of the base of the smoke pipe being located at any portion of the length of the boiler, a matter of great convenience in the construction of sailing steamers. The smoke connections are arched, and consequently afford the required strength without bracing.

Mr. Haswell has also patented another invention relating to steam boilers having a steam chimney—notably marine boilers—which has for its object to strengthen the boiler and to brace the chimney. It consists in retaining the boiler shell between the outer shell and the inner shell of the steam jacket, and jointing it to the latter instead of cutting it out as heretofore. The reclaimed portion is perforated, so as to allow a free circulation of the steam between the boiler proper and the steam chimney. Mr. Haswell is of opinion that the usual removal of this part of the boiler is a cause of weakness, which is obviated by his invention; while, at the same time, he secures increased strength to the chimney and adjacent portions.

Both devices seem to us practical and useful, and there is little doubt but that they will meet in practice with that ready appreciation from steam engineers which is so confidently expressed by them on an inspection of the inventor's models.

Natural Gas for Puddling.

A novel feature in iron working has been introduced recently by Messrs. Rogers & Bruchfield, of the Siberian Iron Works, Pittsburgh, which consists in the application of gas from a gas well as fuel. Their mill is situated at Leechburg, Armstrong county, and is devoted to the manufacture of sheet iron. The well is situated on the opposite side of the Kiskiminetas River from the works, and is 1,200 feet deep. The gas is let from the well through steam pipes into a horizontal cylinder, with safety valve near by, and thence across the river to the mill. Here it is fed under the boilers through a horizontal pipe, running longitudinally their entire length, pierced with small holes. A very perfect combustion is secured in this way. It is fed in the puddling and heating furnaces in like manner, through a pipe in the rear of the fire bridge, but here the combustion is not so perfect, and considerable black smoke is seen issuing from the stacks. An ample supply of gas is furnished by the well, and at a very regular pressure, which has not been measured, but is thought to be over 30 lbs. The volume of gas used is easily controlled by cocks, and can be adjusted for various purposes with the utmost nicety. "Mr. Rogers estimates that the saving to them in fuel amounts to $700 per week and states that they obtain 33⅓ per cent more yield from the metal than they did when using coal—at the same time producing an article of very superior quality, on account of the purity of the gas. The firm is now manufacturing an article of tin plate, which they claim to be equal, if not superior, to any manufactured abroad, which they could not do when using coal. The well was bored for oil originally, and had been in existence some four years when the idea was conceived to utilize its gas in this way, four months ago.

Our readers may remember that on page 370 of our last volume we gave an account of the gas wells of New York State, as presented by Professor Wurtz, who shows that there are three belts of gas wells running across this State. In view of the successful application of natural gas to puddling in Pennsylvania, he suggests a trial boring here. "Think," he says, "what a noble thing may be before us: should we find ourselves able to tap and draw from stores of gas pent up under the Catskill range, conduct this gas to the brink of tide water along the Hudson, and operate therewith upon the pure limonites of Putnam, Dutchess and Columbia, and the magnetities of Orange and Rockland, Champlain and the Adirondacks. "Making two blades of grass grow where one grew before" would be a feeble figure of speech to apply."

Hygienic Treatment of the Aged.

Mr. Habershon, in a clinical lecture at Guy's Hospital, London, referring to the case of an old man, remarked: "The man died simply from the shock produced by coming out into the cold and fog, which, though only an inconvenience to us, was sufficient to lead to a fatal result on one whose circulation had become enfeebled, and whose vital force had so nearly lost its power. I am reminded, by this case, of an instance of longevity communicated to me by a gentleman the other day. His mother, who had died at the age of one hundred and two, during the winter months 'had refused to get up, saying that she was only warm in bed.' I have no doubt that it was owing to this uniform, warm temperature that she lived so long; and I mention the instance as a recommendation for you, when you have to prescribe for old people, to advise that they be kept warm. You should also look carefully after their nourishment. Old people cannot eat large meals; therefore they must take them more frequently. Many old people will wake up about three or four o'clock in the morning. It is a good plan that they should have some nourishment then; otherwise the interval between the night and morning meals is too long for their declining strength. It is by care in such minutiæ that we may prolong the life of the aged."

The Magnetization of Steel.

If a recently tempered steel needle be introduced into a magnetizing bobbin connected with a battery of constant current, battery and bobbin comprising the circuit, it acquires a total determined magnetism at the end of a period which appears not to exceed that of its introduction. On slowly withdrawing the needle, it is found to retain residual magnetism which, together with the total magnetism, increases with each repeated introduction until a limit is reached. The needle may be magnetized in the bobbin by three other methods:

1. *Establishment.*—Introduce the needle; establish the current; slowly withdraw the needle.
2. *Interruption.*—With a closed circuit introduce the needle slowly; break the current and withdraw the needle.
3. *Instantaneous Charge.*—Introduce the needle; establish and break the current; withdraw the needle.

Repetitions of any of these three processes (all things being equal) insure an augmentation of the needle's magnetic moment.

THE LARGEST LOCOMOTIVE IN THE WORLD.—A correspondent states that the largest locomotive in the world is the "Pennsylvania," on the Philadelphia and Reading Railroad. The principal dimensions of this engine are as follows: Diameter of cylinders, 20 inches; length of stroke, 26 inches; number of driving wheels, 12; diameter of drivers, 4 feet; and the weight of the engine alone is 60 tuns.

CEMENT FOR CAUSTIC LYE TANKS.—The tanks may be formed of plates of heavy spar, the joints being cemented together by a mixture of 1 part of finely divided caoutchouc, dissolved in 2 parts of turpentine oil, with 4 parts of powdered heavy spar added.

Qualities Most Estimable in the Rose.

A rose, taking all things into consideration, is, perhaps, the most splendid of flowers. Throwing aside the national affection for our emblem, the rose is appreciated for itself. It has qualities peculiar to itself. It is beautiful, from the moment when the color peeps from its green covering, until its flower is complete—handsome in all its stages. Its perfume is unequaled; and whether it be a single bud or bloom in the hand, a bush in the border, a tree on the lawn, or climbing the pillar, or winding around the archway, or covering the front of a house, it is equally admired.

In estimating the various qualities which give value to the rose, we are almost inclined to place that of continual blooming first, even before perfume, although without this a rose loses its great charm; but continuous flowering is of so much importance, the prolonging of the beauties of the garden is so essential, that we think it of more consequence than any other feature. See a garden, liberally planted with summer roses, in a blaze of beauty in June or July, and it is a second paradise; but what is it before or after that period? The rose trees bereft of adornment are eyesores; they are, in fact, in the way until they bloom again. But see the same or another garden, judiciously supplied with continuous blooming roses of the nature of the common China, and we have them in flower the last of all our favorites. A frost that will kill down dahlias to the ground will only injure the flowers of the rose; the buds are scarcely damaged, and it is not an uncommon thing to see continuous blooming roses flowering in a mild autumn up to Christmas; and be it remembered that we have now hundreds of beautiful varieties possessing this valuable quality.

We now come to a quality which is of more importance than it at first seems—namely, thickness of petal. The advantages of this are, first, that, whatever be the color, it is more dense than it can be in a thin petal; but apart from the superiority of color, thick petals are more lasting than thin ones, and sun and winds have less effect upon them. A rose with thick petals will remain perfect for days, while thin ones are burnt or shrivelled in a few hours; and we hardly know of a more disagreeable fault than speedy decay. To see the ground strewed with petals in a few hours, and the plants disfigured by the remains of decayed flowers, is very far from pleasant, and this is inevitably the case with thinly petaled roses.

Upon the whole, the qualities of a good rose are—continuous blooming; thick, smooth-edged petals; flowers round, forming half or two thirds of a ball, very double and full-faced, very symmetrical and imbricated; wood short-jointed; color dense, that is, whatever its shade be, the color decided; and, if striped or blotched, the stripes or blotches well defined.—*The Farmer.*

Training of Boat Rowers.

At some of the colleges the training of the racing crews is about as follows:

In the morning an easy walk of an hour's length, at noon a quicker walk of half a hour, and in the afternoon a pull of seven or eight miles, after which comes a bath and a good rubbing down. The system of diet is rather one of proscription than prescription. Certain articles well known to be unwholesome are proscribed. Other things may be eaten. Pastry, tobacco, coffee, pork, and all stimulants are ruled out. The crew pulled a plain forward and back stroke, with no special pretension to style or scientific points, making generally 32 strokes to the minute.

Car Couplers, Draw Bars, and Buffers.

It appears from the discussions of the Car Builders' Association that the members are not quite decided as to which of the various devices for couplers, draw bars, and buffers they ought to recommend for general adoption. The subject is regarded as one of great importance, and is continued for another year.

RECENTLY PLANTED TREES AND SHRUBS IN HOT WEATHER.—This is a trying time for young trees. Those that were set this spring, and have appeared to be doing well thus far, may succumb to the long continued drought and heat of midsummer. It is safest to mulch all young trees; but where this has not been done, all those that show signs of suffering should be attended to at once. A timely mulching may save the tree. It makes but little difference what material is used so that the soil around the tree is prevented from losing its moisture by evaporation. Stones, if most convenient, will answer as well as anything. If the trunk is fully exposed to the sun, it should be protected from intense heat. A couple of boards, tacked together like a trough and set up against the trunk, will furnish the required shade; or the trunk may be bound with a hay rope, or be loosely strawed up as for winter protection.

A CORRESPONDENT, J. H. says: "I consider the SCIENTIFIC AMERICAN to be an actual necessity in my shop, and I do not intend ever to be without it. I have gained more information from it than from all other papers and books combined. I have been a constant reader of it for nearly thirty years, and you may put me down for a life subscription."

CHARLES MERRILL & SONS have just completed, for the Lallance and Grosjean Manufacturing Company, of this city, the well known manufacturers of stamped tin ware (known as French tin ware), the largest drop press, we believe, yet made, it having a hammer and die 36 inches in diameter, weighing 2,000 pounds, and falling 3 feet 6 inches. The base of the drop weighs 6 tuns, and its elevation is about 12 feet.

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IMPROVED HAY AND COTTON PRESS.

The invention represented in the annexed engraving is a novel and simple form of hand hay or cotton press, designed to replace the more cumbrous machines usually actuated by horse power. The present device, we are informed, can, if necessary, be operated by one man, and two men can, it is stated, by its aid, bale from six to eight tuns of hay per day.

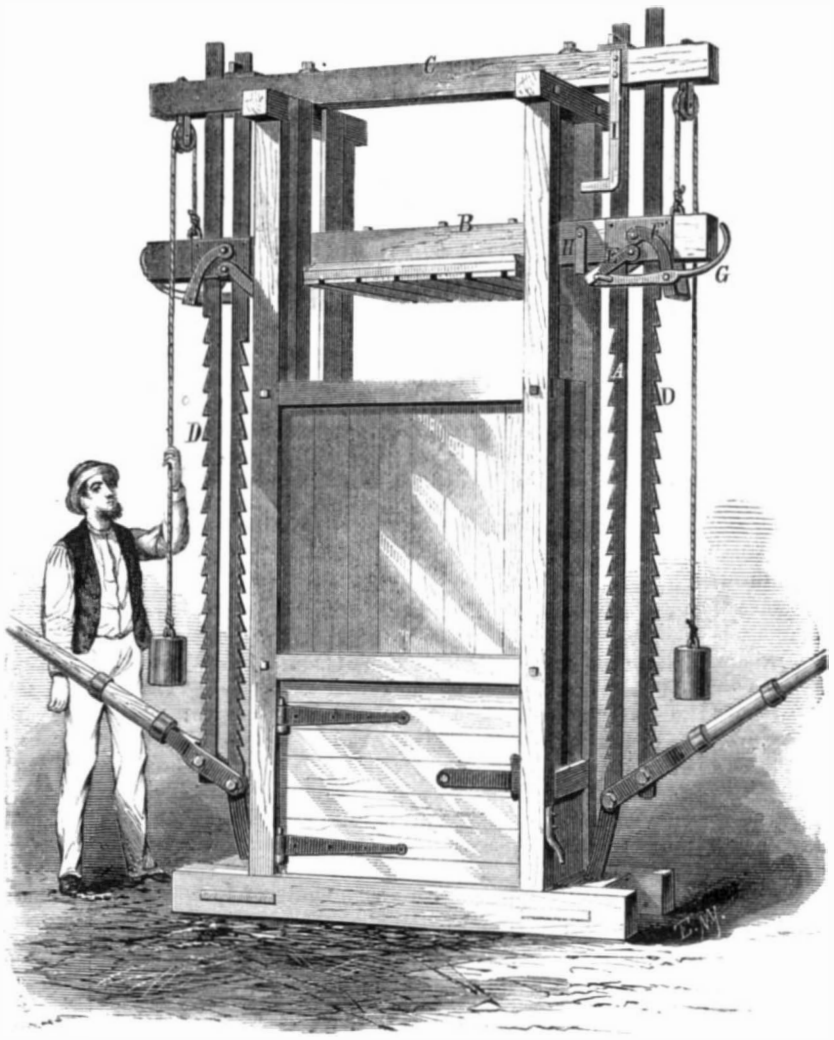
A are toothed bars secured to the lower cross piece of the frame, which pass up through slots in the follower beam, B, and are attached to the upper cross beam, C. At D are other bars notched outwardly, also passing through a slot in beam, B, and attached to beam, C. To their lower ends are pivoted the hand levers, as shown, the inner extremities of which work upon the bars, A, so that by means of said levers the bars, B, may be moved up and down.

Pivoted to the ends of the follower beam, B, are stirrups, E and F. E passes around the bar, A, so as to engage in its teeth, and thus hold the follower against the back pressure of the material being baled. The other stirrup, F, passes around the movable bar, D, so that, as the latter is raised by the lever, it will slide through the stirrup; but as the bar is drawn down, its teeth will catch in the stirrup, and thus carry the follower down with it, so compressing the material. The teeth of bars, A and D, are made larger at the upper end, and gradually become smaller toward the lower end of the bars, so that the press is worked with the greatest advantage of leverage where the heaviest resistance is encountered.

To the follower beam are connected ropes which, passing over guide pulleys, carry weights which balance the follower at any desired point. G is a short lever which is pivoted to one of the stirrups. Its inner end is so formed as to strike against the opposite stirrup, E, raising the latter away from the teeth of bar, A. The lower part of stirrup, E, then strikes a stop, H, attached to the follower beam, and is arrested, causing the lever, G, to raise the stirrup, F, from the teeth of bar, D, in which position lever, stirrup, and stop lock themselves, so that the follower may be readily elevated.

As the follower rises, a pin on lever, G, strikes a stop, I, on the framework of the press, which disengages the lever and allows the stirrups to drop, ready to take a new hold of the teeth on the bars when the hand levers are again operated.

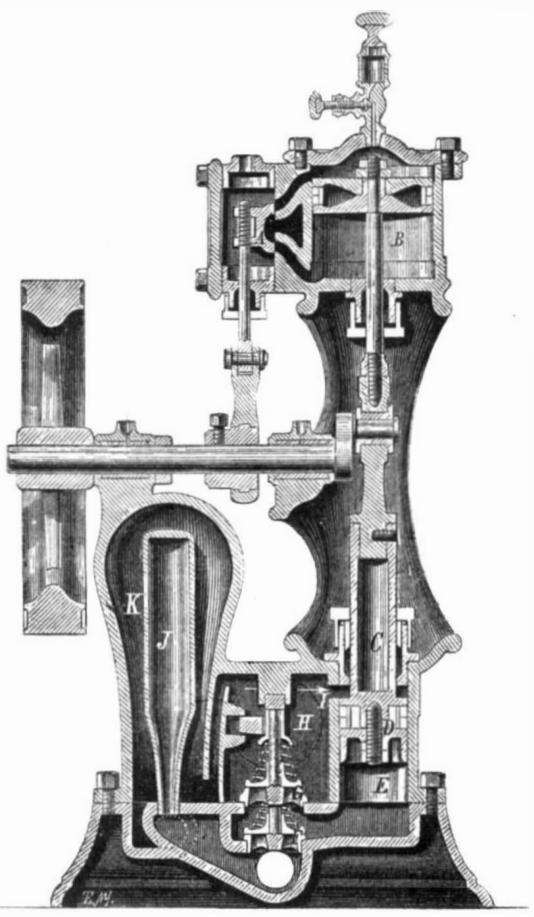
Patented through the Scientific American Patent Agency, April 21, 1874, by Mr. M. Mickelson. For further particulars address the owner of the patent, Mr. O. A. Davis, Ashland, Jackson county, Oregon.



DAVIS' HAY AND COTTON PRESS.

AN IMPROVEMENT IN STEAM PUMPS.

The Wright patent double-acting bucket plunger steam pump, an engraving and description of which, not very long ago, appeared in our columns, has recently been made the subject of some valuable improvements which will doubtless tend to add considerably to the efficiency of the machine. The points of novelty consist in constructing the apparatus much heavier than ever before, a complete set of new patterns (nine sizes) having been made for the purpose. Bronze or gun metal has also been substituted for yellow brass, and steel has replaced iron, in portions where the latter metals were formerly employed. By simple modifications the water valves may be removed from the pump with great readiness. By the unscrewing of a single nut and the withdrawal of a key, which is inserted by hand, the discharge valve and seat may be taken out, thus giving access to the suction valves underneath. The key above mentioned is not driven in, but its end rests against the hand hole cover, so that it cannot work out of place.



The valves are simply circular pieces of metal, rubber, or leather, rising on a stem, which is fastened to the valve seats. Thus, should a valve fail, a circular piece of leather or rubber packing would answer temporarily until something better could be obtained.

Another improvement is in the lower end of the water plunger, which is now made separate from the remainder of that portion. Packing rings can be hence inserted with but one cut in them, causing them, it is stated, to wear much longer and more evenly than when divided into several pieces, as was necessary in the old style of plunger. The inside ring also being made thinnest at the cut, greater elasticity is gained.

We give herewith a sectional view of the pump, from which the operation will be readily understood. A is the steam valve, and B the steam cylinder; C is the upper and small portion, and D the lower and large portion of the plunger connected thereto. E is the water cylinder, F the suction valve, and G the discharge valve. H is a hand hole for access to the water valves. I is a passage in the upper end of the water cylinder, through which water is taken in on the down and discharged on the up stroke. J is the vacuum, and K the air chamber.

The crank shafts, crank, and pin are in one continuous forging. The manufacturers, the Valley Machine Company, of Easthampton, Mass., (who may be addressed for further particulars), inform us that, out of seven hundred pumps of this description now in use, but one failure has taken place, and that could only be ascribed to neglect.

The agent for the company in New York is I. H. Shearman, 45 Cortlandt street, where the pump may be examined.

Microscopical.

At a recent meeting of the Royal Microscopical Society, Mr. Slack called attention to a slide exhibited under one of the Society's instruments as being a remarkable specimen of Herr Muller's technical skill in mounting. The slide has photographed upon it, in an extremely beautiful and perfect manner, eighty spaces, with the names of diatoms below each, and a diatom of corresponding species was mounted in every space. Mr. Slack said he had received specimens on silica solution in the milky condition described by Mr. Read at the last meeting, but was himself unable to detect any particles suspended in it, though some had been detected by Dr. Anthony. Mr. Charles Stewart described and figured on the board the peculiar position of the touch corpuscles in the skin of the hand, and he also exhibited and described a section of an ascidian, and explained the method of preparation.

The Hotchkiss Marine Log.

The self-registering log, made by Captain Truman Hotchkiss, of Stratford, Conn., consists of a sort of clock which is placed on the taffrail or stern of the ship. A cord is then thrown overboard, to which is attached a small float that has feathers on its sides like a screw propeller. The feathers cause the float to revolve with a speed equal to the progress of the ship, and the float twists the cord which operates the pointers of the clock, and thereby shows at all times, day or night, the exact speed of the vessel in miles per hour, and also adds up and keeps account of the total distance traveled by the ship. We have received a letter from Captain Blakeman, commander of the large steamship Isaac Bell, plying between New York and Richmond, who states that this log has been for a considerable time in actual use on that steamer, with entire success. He informs us that during six passages between the Highlands of Neversink and Cape Charles, the log indicated substantially the same distance and corresponded in its showing with the government chart. Captain Blakeman considers it a valuable assistant and safe guard for navigation, and thinks that no ship, whether steamer or sailing vessel, ought to go to sea without the clock log.

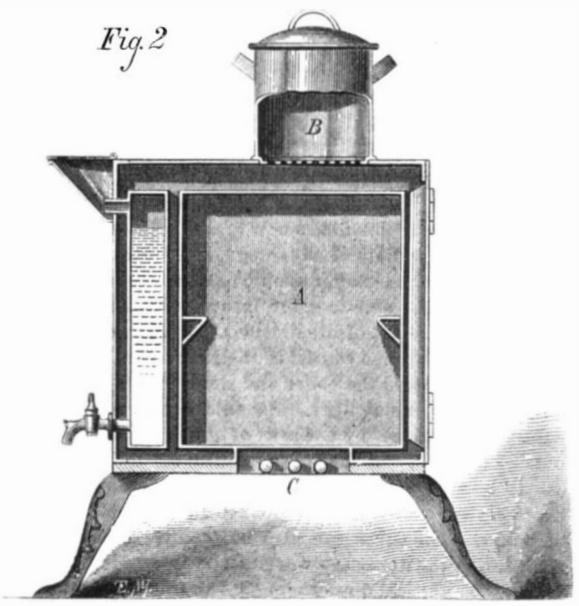
A NOVEL COOKING STOVE.

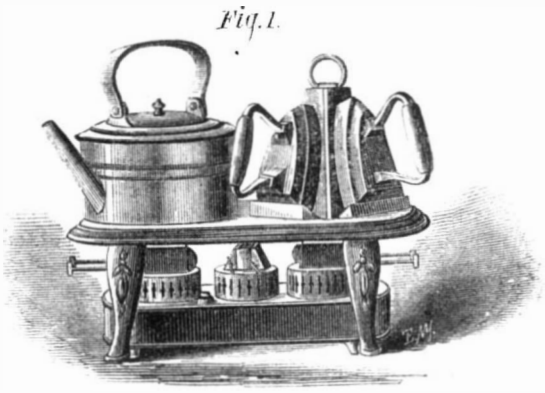
The necessity of constantly maintaining a coal fire in a range or cooking stove during hot summer weather, in order to perform the necessary culinary operations, is an annoyance which many families would gladly be rid of. A device which avoids the trouble, saves fuel, and, at the same time, forms a convenient substitute for the range, is represented in the annexed engraving. It consists of an ingeniously contrived stove, which, in a short time, can be heated by a coal oil lamp sufficiently to fulfil all culinary or laundry requirements. When no longer needed, the flame can be extinguished, and the heat, which would otherwise render the kitchen and house uncomfortable, be done away with.

In Fig. 1 is shown the peculiar form of lamp, in which any kind of oil may be used, and which requires no chimney. There is a central air tube between the wicks, and air passages outside of the latter. A suitable air chamber protects the oil from the heat of flame. The arrangement is such that a current of air is brought in contact with the tip of each wick, thereby supplying oxygen and causing, it is claimed, a clear and smokeless flame. Means are provided for regulating the size of the latter, and consequently the heat, and also for governing the draft.

A sectional view of the stove will be found in Fig. 2. A is an oven, at side of which is a hot water tank. Heat is applied to the tubes at C. B is a steamer having a perforated bottom.

The inventor claims that the stove will roast 12½ pounds of meat in two hours and a quarter, and will bake a loaf of bread, 3 pounds in weight, in one hour. It will heat water, steam vegetables, and roast meat at one and the same time. It is claimed to steam potatoes perfectly in half an hour: and, in brief, will do any cooking that can be accomplished





with an ordinary coal stove. There is no smell from the lamp

Patent pending through the Scientific American Patent Agency. For further particulars regarding sale of rights, etc., address the inventor, Mr. James Iredale, 101 Queen street, Toronto, Canada.

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MORE CURIOUS VEGETATION.

We give below descriptions of four curious plants, in which, while proving novelties to the horticulturist, will be found many features of interest to the student of botany. With one exception none are indigenous to this continent, and, so far as we are aware, no specimens of the peculiar species represented are under cultivation in the eastern portion of the United States.

The plant represented in the first engraving—for which, with the other illustrations, we are indebted to the English *Garden*—is a cycad. It is not a quick grower, but very permanent in its character, as are all the other species of similar ferns. Other species in this group are also very effective when well grown, and none more so than the *e. horridus*, a stout dense-growing form, with spinose foliage, and one of the most striking of all foliage plants for conservatory decoration. *E. Caffer*—or, as it is popularly called, Hottentot bread—is another noble plant, forming, as it does, a fine trunk, surmounted by deep green, leathery foliage, which droops or arches gracefully on all sides. There are some good specimens of this in the palm house at Kew, England, and it deserves a place in every collection of warm conservatory plants. Cycads are as invaluable and as deserving of general culture as are the palms themselves, although they are more limited in number. Many come from the Cape district and Natal, or Southern Africa, where they form distinctive features of vegetation.

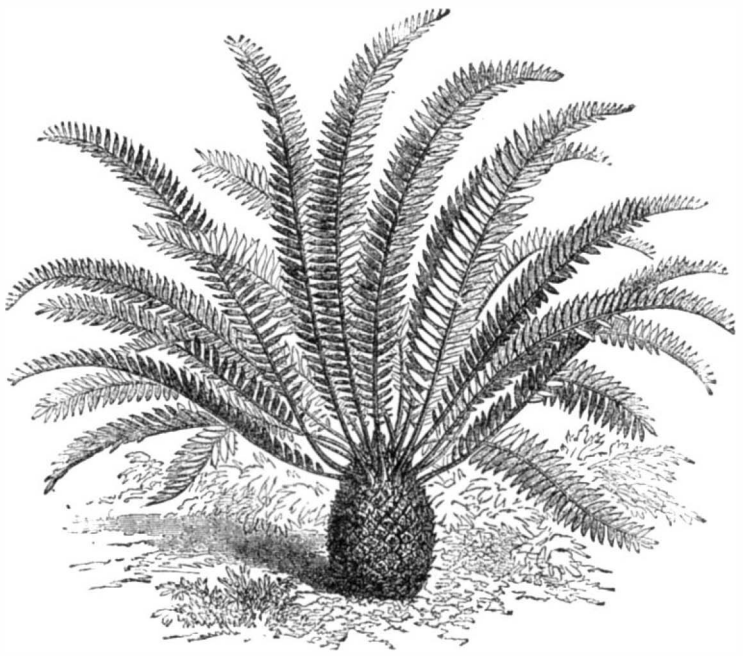

FIG. 1.—ENCEPHALARTUS ALTENSTEINII.

The odd-looking plant shown in our second illustration belongs to the genus *Dicksonia*. They are distinguished by their coriaceous fronds, the sori being situated upon the end of a vein near the margin of the pinnules, and inclosed within a coriaceous two-valved involucre.

The species represented is the *D. antartica*. The stem is both tall and stout, attaining in its native country, we are told, to from 30 to 35 feet in hight, and measuring from 1 to 2 feet in diameter. Upon the summit of these stately stems is borne a grand crown of dark green, plume-like, somewhat coriaceous fronds, which vary from 3 to 10 or more feet in length. The young fronds are beautifully arched, but with age they bend over and become more pendulous. The beautiful symmetry of this stately plant cannot fail to recommend it to every plant grower. It would appear to be common in mountain gullies and ravines in Tasmania and Australia.

Although the flowers of the stapelias are not merely devoid of fragrance, but exhale a repulsively fetid, carrion-like odor, many of them are, nevertheless, beautiful in color and singular in form. There are about ninety species of these plants, all of which are natives of the Cape of Good Hope, with the exception of *s. Europea*, which is found in Spain and Algeria, as well as in South Africa. *S. hirsuta minor*, of which we give an illustration in Fig. 3, and the allied species emit such a powerful scent of decomposing flesh that the common blow fly is deceived into depositing its eggs among the hairs of the corolla. Its numerous succulent stems are thickly set with quadrangular, conical, ascending branches, forming tufts from 12 to 16 inches in hight. As in the genus cactus, the leaves are very rudimentary, being reduced to insignificant scale-like processes. The flowers are solitary, from two inches to two and a half inches in diameter, and are produced near the bases of the branches. The petals are thick and fleshy, smooth, and greenish on the under side, very much wrinkled on the upper surface, marked near the base with transverse sinuous lines of purplish brown, and marbled and spotted all over with blotches of sulphur

FIG. 2.—DICKSONIA ANTARCTICA.

yellow. The bottom of the corolla is concave, circular, and of a purplish brown color in the center, while the edges are marked with yellowish spots. The structure of the stamens is very singular. From the bottom of the corolla rises a sort of cup, nearly pentagonal in shape, the upper part of which is divided into ten narrow strips, five of which are turned inwards and five outwards. The five inner divisions are straight, cylindrical, slender, and covered with purplish tubercles. Each of them is again subdivided into two parts, of which the outer one has a thickened apex, and is bent over the pistil; the other, or inner division, is quite straight. The five external primary divisions are of a green color, spotted with purple, are flat and oblong in shape, and forked at the apex. The anthers are of an orange color.

Fig. 4 is a California cypress, described by some authors as a variety of *c. Californica gracilis*, while others make it a distinct species. It forms a small bushy tree, from 16 to 20 feet high, with numerous spreading branches, and small scale-

FIG. 3.—STAPELIA HIRSUTA MINOR.

like leaves, closely set together, broad at the base and pointed at the apex. It is particularly distinguished by the shape of its cones. These are of a dark brownish color, streaked with lighter lines, each of the four scales bearing, near its apex, a horn-like projection, nearly half an inch long, whence it derives its specific name, *cornuta*. These horns are generally curved at the point, as shown in our engraving, which represents the cones in their natural size. The tree is a native of the mountains of California, and is a hardy and tolerably ornamental subject.

Dog Killing by Electricity.

Whether the slaughtering of scores of dogs by carbonic acid gas, as practiced in this city, is a painless operation to them seems rather questionable from the length of time which their struggles continue. A correspondent asks why cannot electricity be used? He suggests that, with a powerful battery and a good sized Rhumkorff coil that will give a spark of from twelve to eighteen inches, thirty or forty dogs at a time might be killed instantly and painlessly. The wires could be led along the floor connecting with every staple to which the animals are secured. The chain and metal collar would serve to conduct the shock to the body.

WATERPROOF SILK PAPER.—Silk paper is allowed to float for a little time on the surface of an aqueous solution of shellac in borax, and then dried in the air. By the admixture of a small quantity of an aniline color with the borax, colored papers are obtained.

Korting's Condenser.

We notice that a Mr. Körting has invented and introduced a novel condenser, in which the work required to eject the condensed water is performed by its own velocity, instead of by the old-fashioned air pump and hot well. The condenser is of the old injector principle, in which the exhaust steam is admitted by various concentric cones around a stream of falling water. This disposition of parts causes the exhaust steam from any cylinder to offer a large surface to the cold water. Condensation is thereby effected, and a very considerable velocity is produced in the descending column of water. This causes a considerable vacuum behind the falling column. In order to produce the required effect, it is necessary that the falling water should have a small initial velocity. In M. Körting's arrangement, the water has a velocity due to a head of 9·85 feet. The water is pumped up into a tank at that hight by means of a pump attached to the engine; so that the power required to work this pump must be deducted from the effective gain of the condenser. The advantages of the apparatus are thus summed up.

1st. Its price is not more than from an eighth to a quarter of an ordinary condenser. 2d. There is no need for any foundation, and consequently it is easily applied to existing engines or to new ones. 3d. It works without air pump, which saves the loss of work and the inconvenience of setting up and of operation of the latter. 4th. There is nothing to regulate, and, in consequence, it demands no particular care from the attendant. 5th. As there are no moving parts (pistons, valves, etc.), there is no wear, repairs, or interruption in work. 6th. Its application is especially advantageous to small machines, where the inconvenience and the price of an air pump is very great.

Atmospheric Dust.

M. Vorlet d'Aoust says, in *La Nature*, that in Mexico deposits of atmospheric dust occur in beds of sufficient thickness to stamp them as true geological layers. These strata, which have frequently formed a puzzle to geologists, are composed of a yellowish clayey earth, which not only envelopes isolated mountains but forms the flanks and bases of some of the most elevated ranges, such as those of Popocatepetl and Ouzaba. The revetment extends upward to a hight of about 12,000 feet and in its lower portions varies in thickness from 180 to 320 feet.

In the midst of the deposit are found blocks if stone and detached fragments which have rolled down the mountains and which have become agglomerated by the dust as if by cement.

The dust is raised by dust storms (*remolieros de polvo*), which frequently occur on the Mexico plains. These throw up great clouds to hights of 1,500 and 2,000 feet in the air, often obscuring the sky and changing its blue to a yellowish color. The dust is then blown by wind currents toward the mountains, which act as a barrier and check its further progress; for, once deposited on their slopes, it cannot again rise as the storms take place only on the plains. It is curious to notice that this action of the atmosphere completes a circle begun by the water. The latter carries earth from the hills down to the plains, where it is transported back to the mountains by the winds, and so a continual circulation is maintained.

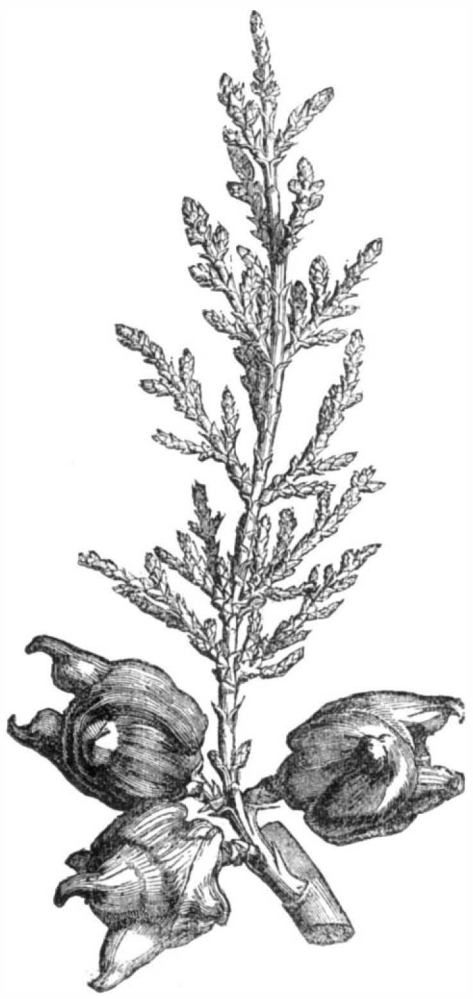

FIG. 4.—CONES OF CUPRESSUS CORNUTA.

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MEDICAL NOTES.

Erysipelas.

Professor D. M. Salazar, of Madrid, reports that he has cured eight cases of facial erysipelas in 48 hours by the use of glycerin of borax, without any ill effect following. He applys the solution to the diseased parts with a brush, and then covers them with a mask of raw cotton.

In erysipelas in general, tincture of muriate of iron, used internally and locally, has been the chief remedy of late, but it is found not to be proper in all cases. When the redness of the inflamed part is vivid and deep, and there is increased redness of tongue and mucous membranes, the iron tincture is the true remedy. Internally it may be given in doses of from 5 to 20 drops every three hours, and outwardly applied from full strength to a dilution of one part to 8 or 10 of water and glycerin. Erysipelas has been cured with veratrum alone, used internally and externally, when the cases were marked by high febrile action and a full pulse. In other cases of the zymotic type, when the cellular tissue is affected, the remedies should be taken from the group o antiseptics. Sulphite of soda is good when the tongue is pallid and dirty. The dose is 10 to 20 grains every four hours. Chlorate of potash has been tried with good effect. In phlegmonous erysipelas, permanganate of potash solution is the best outward application. In these cases the color is purplish or dusky. Carbolated glycerin is also a good dressing. It should not be forgotten that, in erysipelas of children or of adults where the skin is very sensitive, a simple dressing of fresh lard will often give the best results.

To conclude the subject of erysipelas, the collector of these notes would mention that he has observed the cause of the disease twice in himself and two or three times in others, where there was no doubt. That cause was animal fat, either fat fowls or, generally, lard and pork used to excess. It seems that the disease is very frequent in the West during winter, hog's fat being eaten there most extensively. Those who have never had the disorder can easily bring it on by persistence in such diet; and though it will trouble even when it is light, yet, if they try the remedies above mentioned, and especially the lard or bacon fat when the complaint ends with a ticklish itching in the palms of the hands and soles of the feet, they will be almost amused. In acute erysipelas, the bane and antidote are one, as a rule.

Iodide of Potassium.

This chemical is used to a vast extent; but after a thousand prose pœans in its praise, many doubts begin to be expressed as to its value. Some of the best physicians of the old and new schools assert that the iodide is sometimes a failure, and sometimes much worse. The most discriminating doctor of the lot seems to us to be Dr. John M. Scudder. He says: "If your patient has a pallid tongue, especially of a dull leaden color, large, sodden, immobile, you have the indication for the drug, and then it becomes a remedy. If the color of the tongue is deeper than is natural, whether dusky red, purplish, violet, or bright red, if it be contracted, pinched, pointed, dry, then the iodide is contra-indicated, and will probably prove a poison."

Hypodermic Injections.

Subcutaneous or hypodermic injection of medicines, namely injection, by very fine pointed syringes, of liquids into the cellular tissue, form the grand new feature of medical practice. Until recently, these injections have been confined to narcotics or anæsthetics, where they have accomplished their object better than by the old style of dosing or inhaling, but in some cases the amount has proved too great. At this time, the trials of new articles used in this way for a host of diseases would require a volume to give full account of. We condense a few of the more important experiments. Dr. Zülzer, after having used every other medication, without success, in exanthematic typhus, and finding the pulse imperceptible, the extremities cold, the voice inaudible, etc., employed the ammoniacal tincture of anise in injections, 15 to 30 drops, one injection for each limb. In a few minutes the pulse became fuller and stronger, the death-like appearance and collapsed condition disappeared, and a good number of patients who seemed hopeless owe their life to this means, not sufficiently used. In some cases it caused little abscesses at the point where the injection had been made, but these accidents have never had any serious consequences. The formula is as follows: Oil of anise, 1 fluid dram; alcohol of 85°, 24 drams; ammonia, 5 fluid drams; mix. This medication is indicated in cholera, grave fevers, and paroxysms, where it will permit one to wait the favorable moment for the administration of quinine. Dr. Hüter strongly recommends a two per cent solution of carbolic acid in water as an injection in all inflammations of the cellular tissue. According to his experience, the results are almost miraculous. He says there are no material impediments to the use of these injections in such organs as the lungs and spleen. If he is correct, and a solution of carbolic acid can reach and heal the ulcers in consumption—but it will not do to put entire faith in such a wonder until the experiment has been fully and successfully tried.

Dr. James B. Garrison, of De Witt, Ark., reports a curious case in his own practice, where a man had taken by mistake a large dose of sulphate of morphia. He was unconscious, cold and livid, and the pulse had ceased entirely at the wrist. The Doctor considered the case hopeless, but still went to work vigorously, causing the patient to be stripped, rubbed with dry mustard, then with water, which was poured on head and back, till a very strong decoction of coffee could be prepared; then almost a pint was injected into various parts of the patient's body during an hour, while rubbing with hot flannels and dashes of cold water were kept up. At the end of the first hour his pulse was perceptible at the wrist. The hypodermic injections of coffee were continued for two hours, his skin being perforated in every part where it could be done with safety. The friction and cold water lasted four hours, when the patient could swallow. Then he was made to drink a quart or more of the strongest coffee; quinine and brandy followed, as his pulse was feeble. Finally the man recovered, and did not complain of soreness from all these punctures. The coffee caused no abscesses.

Hypodermic injections of one or two grains of ergotin every few days have cured varicose veins in pregnant women. The same substance, 10 parts to 100 of water, has cured *prolapsus ani*.

New Method for the Transformation of the Alcohols into Nitric Ethers.

This process, recently reported by M. Champion, allows of operation at the ordinary temperature and upon considerable quantities of alcohol. It is founded on the reciprocal action of a nitrosulphuric mixture and of sulphuric combinations of the alcohols; and as this action is progressive, but a small quantity of heat is disengaged. It is otherwise necessary to cause the concentration of nitric acid to vary. Thus, for example, for the alcohols derived from the fatty series, butylic amylic, etc., ordinary nitric acid with an excess of sulphuric acid should be employed: in other circumstances, fuming nitric acid at 118·4° Fah. The sulphuric combinations of the alcohols are obtained by 2 of acid to 1 of alcohol, care being taken to prevent elevation of temperature and the mixture being left to itself for several hours.

This process is possessed of particular interest from its application to the industrial production of nitroglycerin. To glycerin at 30° B., ordinary sulphuric acid is added, care being taken to keep the heat below 122° Fah. After cooling the liquid is turned into a light excess of nitrosulphuric acid. Two pounds or so of this mixture can be almost immediately used, without requiring cooling. Although the temperature rises, it in no case gives place, if the operation be properly conducted, to the violent reaction which results from the action of glycerin on the acids, an effect manifesting itself by a sudden increase of temperature and sometimes by explosion. After a time, which varies with the proportions employed, the oily drops appear. If the operation be performed on some few ounces, the temperature remains constant during several hours. The action continues for twenty hours.

Alcohol.

As the result of the chemical change which sugar undergoes in passing downwards towards a dead, inorganic condition, a substance is produced which has been the cause of more sorrow, crime, and suffering than all other evil agencies that have afflicted the world. It has caused tens of thousands of murders, and uncounted instances of robbery, theft, arson, incest, and suicide; it has brought misery and want into millions of households; it has filled almshouses and asylums with wretched victims; it sends a never ending procession of crime-stained men and women to prison and the gallows. What an awful indictment this is to bring against a substance which stands so closely allied in chemical relationship to innocent sugar! Alcohol is not a natural product; it can only result from a spontaneous change which is excited in saccharine liquids under the influence of a ferment. If in the order of things this chemical change had been impossible, the human race would have been saved from shedding tears, the aggregated volume of which reaches to that of a mighty river. But alas! atoms of carbon, hydrogen, and oxygen are permitted to group themselves in a way to form the maddening liquid; and the great enemy to human happiness confronts us in all our domestic, industrial, and commercial relations. If through disarrangement of Nature's laws, the vinous fermentative process should suddenly cease, and not another drop of any kind of spirituous liquors be produced, no sensible harm would come to any industrial or art process, and no absolute want in medicine would be encountered. Carefully viewing the matter from the standpoints of the chemist, physician, and artisan, we unhesitatingly declare that the world in its present advanced stage has no need of alcohol; it is simply convenient, but not necessary. Why not then make a determined effort to rid the country and the world of the monster? Although alcohol results, as we have said, from spontaneous changes, yet the aid of man is necessary to form the various liquids containing it into attractive and permanent beverages. The fermentation of the juices of grapes and other fruits produces alcohol; but if let alone, Nature will not allow the spirit to remain except for a brief space of time. Nature abhors not only a vacuum, but manifestly one of her products, for alcohol is so unstable in its attenuated combinations that, if left to itself, it speedily runs down into the harmless form of acetic acid.

If man ceases to interfere in the series of natural changes which saccharine liquids spontaneously undergo, alcohol will not survive long enough to do mischief. Why not then compel the great army of men, engaged in isolating and compounding the agent, to let it alone? Alcohol is a poison; it acts inharmoniously with vital processes in the animal organism. In its purest and best form, it slowly undermines the constitution, and hinders or arrests metamorphosis of tissues; in its vile associations, as presented in these modern times, it kills with the certainty and almost with the rapidity of strychnine and arsenic. We ask again, why not attempt to arrest its production, and thus strike a blow at the root of the evil? There is virtue and moral force enough in this country to compel Congress to pass laws prohibiting its importation in any form; and there is virtue and moral force enough in most, of if not in all, the States to compel legislatures to enact laws prohibiting its manufacture. This is the point to which we must, sooner or later, come. All the laws ever made, or that ever will be made, conjoined with all the prayers of all the well intentioned women of the country, will never stop the gnawings of human appetite, or prevent its gratification, so long as rum, whiskey, wine, malt liquors, etc., are imported and manufactured under the sanction of law. Alcoholic beverages must cease to exist, before the world will be released from the terrible thraldom which they exercise over human appetite. In making a remedy for the enormous evils caused by alcohol, nothing absurd or impracticable is associated with the suggestion, and the time is not far distant when the poison will be placed under a ban, as regards its importation and manufacture, which will give a forced emancipation to the tens of thousands of slaves now in subjugation to the monster.—*Boston Journal of Chemistry.*

Cold Applications to the Neck.

Dr. B. B. Richardson, in the London *Medical Times and Gazette*, recommends a neck bag of rubber, with a constant stream of cold water through it, as an efficient means of applying cold locally to the neck. He says:

"I have used this method of applying co'd to the cervical region now several times, in pyrexia, with increasing confidence in its usefulness. In a case of apoplectic seizure, with convulsions, in a lady of middle age to whom I was summoned, I found a temperature of 102° Fah., with deep unconsciousness, rapid pulsation of the carotids, and intense fullness and tension of the jugular vein. In this extreme instance I had the cervical region enveloped in a bladder of crushed ice, with the result of a fall of temperature to the natural standard in six hours, a quiescent condition of the circulation, and subsidence of all the acute symptoms, so marked in character that it is, I think, impossible to doubt that cause and effect were in their true place. This patient made a good recovery, and, although I do not attribute the recovery solely to the special remedy now being considered, I am convinced the remedy was of good service.

I had an opportunity of trying the effect of this mode of applying cold on myself. I took a feverish catarrh, attended with a rise of animal temperature to 100° Fah. I had the bag neatly adjusted, and let pass freely through it water, taken simply from the cistern, the temperature of the day being at freezing point. As the water current began to pass over the front part of the neck, with a gentle pressure which I regulated myself by the stopcock, I felt the effect of the cold very deeply, and at first not pleasantly. In three or four minutes, however, though the skin over the throat was ten degrees lower than on the other parts of body, the sensation of cold was lost, and all unpleasantness was gone. Within a quarter of an hour I was conscious of a general reduction of fever, and of lessened vascular activity. The cold also had a soothing influence, producing desire for sleep. On this followed perspiration, and within two hours a reduction of the temperature to the national standard.

These effects were satisfactory, because no other mode of treatment was employed to complicate the experience.

I shall look out with interest for the results of the observations of other practitioners on this method of reducing pyrexia. It stands on a good physiological basis; I believe its practical worth is clear; and I would that its usefulness were tested by the independent observation of other workers in our common field of labor.

I would urge on those who may study the effect of cold, more or less extreme, applied to the cervical region, to observe the influence it exerts, in different classes of cases upon the heart. If I am correct that it reduces the action of the heart, and if I am also correct in the view that it promotes a tendency to sleep, this remedy, so simple, will prove useful in many other forms of disease than acute pyrexia. In acute mania, in cases of insomnia, in cases of palpitation and cardiac irritability, it deserves the test of experience."

A Good Education.

The late Edward Everett condensed into a single brief paragraph his estimation of what constituted a good education. Here it is: "To read the English language well, to write with dispatch a neat, legible hand, and be master of the first four rules of arithmetic, so as to dispose of at once, with accuracy, every question of figures which comes up in practice—I call this a good education. And if you add the ability to write pure, grammatical English, I regard it as an excellent education. These are the tools. You can do much with them, but you are hopeless without them. They are the foundation; and unless you begin with these, not with flashy attainments, a little geology, and all other ologies and osophies, are ostentatious rubbish."

EXPLORATIONS have recently been made into the mounds of Ottumwa, Iowa. In one, a mass of charcoal, a bed of ashes, and some calcined human bones were found, showing that cremation was practiced by the people who erected them. As Indians never burn their dead, this adds another proof to the theory that they were not the original mound builders. The similarity of the mounds of Mexico and of Iowa point to the fact that they were constructed by the same race of ancient Mexicans.

A paragraph is going about the papers that the largest room in the world under a single roof, unbroken by pillars or other obstructions, is at St. Petersburgh, in Russia, and is 650 feet long and 150 feet wide. It is said to be used for military display. The Grand Central Depot, in this city, is 800 feet long by 240 wide, covering about 4 acres; the roof is supported by the side walls.

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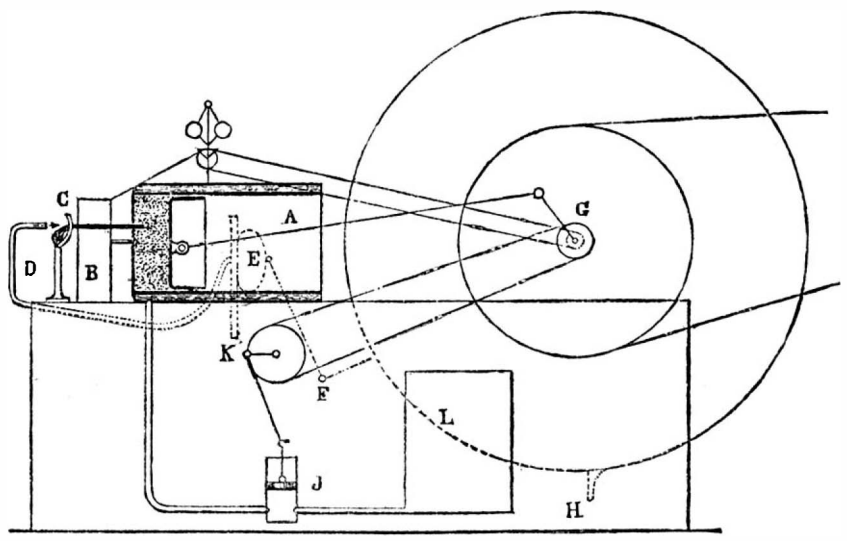
A PETROLEUM MOTOR.

An Austrian inventor has recently constructed the device represented in the annexed engraving, consisting of a petroleum engine, the principle of which is analogous to that of single acting steam engines, with the difference, however, that the expansive force of steam in the latter is replaced by the explosion of the finely divided oil. The *Revue Industrielle* says that the invention has been applied to sewing machines with considerable success. Although purporting to be an Austrian invention, we believe that it is nothing more than a poor copy of the petroleum engine invented by George B. Brayton of Boston, Mass., patented here in 1871-2 and now in successful operation in this country.

At the rear of the cylinder, A, are three valves. The valve in the center is covered with a finely perforated nozzle and allows of the entrance into the cylinder of the oil from a receiver, B. The valve opening on the left allows of the penetration of a flame, C, at the proper moment, said flame being driven through the orifice by air pressure as hereafter described. The effect of the flame meeting the oil in a finely divided state is an explosion, which shuts the two valves and at the same time drives the piston ahead. To the latter is hinged the connecting rod. The crank shaft, G, carries at one end a fly wheel and at the other a common pulley. The fly wheel has a cam, H, which at every revolution strikes against a lever, F, which communicates a pressure to an india rubber air bag, E. The current thus produced is led by tube, D, to the gas or petroleum flame, C, which is thus for an instant elongated and driven into the cylinder as above noted. The petroleum is introduced into the cylinder by atmospheric pressure, through a vacuum being formed in rear of the advancing piston. The return stroke of the latter is caused by the inertia of the fly wheel.



A PETROLEUM MOTOR.

The cylinder is jacketed, and is kept cool by the circulation of water through the intermediate space, forced by pump, J, from a reservoir, L. The governor, shown on the cylinder, connects in the ordinary way with the crank shaft; and by means of a combination of levers, governs the time of entrance of the petroleum. The smoke produced by the combustion of the latter escapes by the third valve before referred to, and into a chimney. The movement of the valve is governed by an eccentric on the crank shaft. The engine has been made of three horse power and is said to work quite cheaply.

The Use of Petroleum Benzin for Exhausting Oleoresinous Drugs.*

Many uses have been discovered for petroleum benzin since it became an article of commerce; and though but recently brought to notice, its applications, from thinning white lead to purifying rare alkaloids, from dissolving india rubber to removing grease from a silk dress, have secured for this product of Mother Earth a name and a place not to be despised.

The immense and overgrown development of the petroleum interest has tended to reduce the price of benzin to a very low figure; the common unpurified article is a drug in the market; and although efforts are constantly made to fit it for illuminating purposes, a means of rendering it free from liability to explode and to cause fearful accidents is yet to be discovered.

The purified benzin commands a much better price, is put to finer uses, and should alone be used for solvent purposes in pharmacy; the common article is unfit for any purposes in a preparation, for it will be sure, from its offensive odor, to leave its tracks in it.

The first requirement, in answering the query: What merit has petroleum benzin as a solvent for the extraction of oleoresinous drugs, like buchu, chenopodium, etc.?: was believed to be to secure a good benzin. This was readily done, and an article having the specific gravity of 0·642 was obtained, which on being tested proved to be free from objectionable impurities, and no odor was left on a clean sheet of paper when a small portion was poured on it, and suffered to evaporate.

Eight ounces of finely powdered buchu leaves were taken, and firmly packed in a Squibb's glass percolator, with the siphon arrangement. It was found to be best, however, to substitute the rubber lid for one made of wood, the wooden lid having a groove cut in the under surface to fit the rim of the percolator; and at the bottom of the groove, a rubber band made the joint airtight.

After allowing the powder to macerate for four days, the siphon was started, and the percolate, very dense and highly charged with extractive matter, came over, at first slowly, and afterwards rapidly; after two pints had passed, the buchu seemed to be exhausted, and so great had been the solvent power of the menstruum, so far as the chlorophyll and other coloring matters were concerned, that the residue looked as if it had been bleached.

The percolate was allowed to evaporate spontaneously, and the amount of oleoresinous extract obtained weighed 305 grains. This, at first sight, was supposed to contain all the active properties of the drug; and in order to test it, five grains were swallowed in a little water by the writer, producing, however, but little diuresis; the dose was increased to ten grains, which had but moderate effect.

Taking the dose of fluid extract of buchu at a fluid drachm, and granting that, one fluid ounce of the extract represents one ounce of the drug, it can be readily be seen, by a simple calculation, that, if the benzin had fully extracted the virtues of the buchu, five grains of the oleoresinous extract obtained would produce the same effect as a fluid drachm of the fluid extract, while ten grains would be a large dose.

This fact suggested that, although the buchu had every appearance of being thoroughly exhausted, it might yield some activity to alcohol, and it was then percolated with stronger alcohol, and a dense, dark colored liquid obtained, possessing a bitter taste and considerable odor.

Ten grains of this liquid produced active diuresis, and the writer has no hesitation in asserting that he believes alcohol to be much the better solvent for buchu.

Various other experiments with other drugs are now progressing, but sufficient progress has been made to justify the assertion that the uses of benzin in this direction are circumscribed; the principal objections to its use being inflammability and great volatility; it requires the use of apparatus not always at the command of all pharmacists; the odor is objectionable generally, and in many cases could not be tolerated by a weak stomach. A continuance of this subject was requested, in order to obtain further information with other plants.—*Joseph P. Remington.*

*Read before the American Pharmaceutical Association, September, 1873, and reprinted from the "Transactions."

Medical Value of Asparagus and Celery.

A medical correspondent of an English journal says that the advantages of asparagus are not sufficiently appreciated by those who suffer with rheumatism and gout. Slight cases of rheumatism are cured in a few days by feeding on this delicious esculent; and more chronic cases are much relieved, especially if the patient avoids all acids, whether in food or beverage. The Jerusalem artichoke has also a similar effect in relieving rheumatism. The heads may be eaten in the usual way; but tea made from the leaves of the stalk, and drank three or four times a day, is a certain remedy, though not equally agreeable.

So the English paper says. It may be well to remark that most plants which grow naturally near the sea coast contain more or less iodine, and in all rheumatic complaints iodine has long been a favorite remedy. One who was long in the drug business told the writer some years ago that many o the popular patent nostrums which some disinterested people—"for the good of their fellow creatures"—sold at two dollars a bottle, consisted simply of a few cents' worth of iodine in solution.

Iodine is dangerous, however, in overdoses, affecting especially the eyes. The same effect may be produced by eating abundantly of asparagus or celery, which are well known seaside plants. If these have no effect, the patent specifies will have none, and in that case a conscientious and intelligent physician is the best resort.

The Microscopic Examination of Well Water.

The author has sought an expeditious method of determining the quality of drinking water, and recommends the use of the microscope in detecting salts in solution by their crystalline form. For this purpose, a few drops of the water under examination are evaporated on a slip of glass either at a high or low temperature, and the forms of crystals obtained are compared with those of known salts, dissolved in water and recrystallized in the same manner. In this way one can detect with dispatch and certainty, common salt, calc spar, gypsum, etc., and to a certain extent the relative quantities present.

Sausages Colored by Aniline.

Aniline red is used to impart to sausages a fresh and healthy appearance. It can easily be detected by the use of alcohol or ether, either of which substances dissolves aniline, but not blood. The use of aniline red is severely reprehensible, not only from the fact that it is known to have caused the illness of entire families who have eaten meat colored with it, but also because, from its mode of preparation, it frequently contains arsenic, and must, therefore, act as a poison.

ICE is now selling in New York city at $20 a tun retail. This high price is alleged by the dealers to be necessary on account of the slim supply obtained last winter. The estimated cost of producing ice by machinery is $3 a tun. There is evidently a wide margin for profit and a good opportunity for inventors to bring out effective ice-making machines.

New Method of Coloring Metals.

Metals may be colored quickly and cheaply by forming on their surface a coating of a thin film of a sulphide. In five minutes brass articles may be coated with any color, varying from gold to copper red, then to carmine, dark red, and from light aniline blue to a blue white, like sulphide of lead, and at last a reddish white, according to the thickness of the coat, which depends on the length of time the metal remains in the solution used. The colors possess a very good luster; and if the articles to be colored have been previously thoroughly cleaned by means of acids and alkalies, they adhere so firmly that they may be operated upon by the polishing steel.

To prepare the solution, dissolve 1½ ounces of hyposulphite of soda in 1 pound of water, and add 1½ ounces of acetate of lead dissolved in ½ pound of water. When this clear solution is heated to from 190° to 210° Fah., it decomposes slowly and precipitates sulphide of lead in brown flakes. If metal be now present, a part of the sulphide of lead is deposited thereon, and, according to the thickness of the deposited sulphide of lead, the above colors are produced. To produce an even coloring, the articles must be evenly heated. Iron treated with this solution takes a steel blue color; zinc, a brown color; in the case of copper objects the first gold color does not appear; lead and zinc are entirely indifferent.

If, instead of the acetate of lead, an equal weight of sulphuric acid is added to the hyposulphite of soda, and the process carried on as before, the brass is covered with a very beautiful red, which is followed by a green (which is not in the first mentioned scale of colors), and changes finally to a splendid brown with green and red iris glitter. This last is a very durable coating, and may find special attention in manufactures, especially as some of the others are not very permanent.

Very beautiful marble designs can be produced by using a lead solution, thickened with gum tragacanth, on brass which has been heated to 210° Fah., and is afterward treated by the usual solution of sulphide of lead. The solution may be used several times.

Black Leading of Iron.

In these days of general diffusion of chemical knowledge, it is scarcely necessary to state that the "black lead" or "plumbago" of commerce is not lead at all, or any compound of lead, that it includes no lead whatever in its composition. Neither is it a carburet of iron, as is sometimes stated. It is simply carbon; pure plumbago is pure carbon, impure plumbago is impure carbon. Its proper name is graphite, that is, writing stone. I may venture to describe it as the softest of all true solids, and have often pondered wonderingly upon the apparently unnoticed, but very curious chemico-mechanical, paradox that the hardest and softest of all the solids existing upon this earth are, chemically speaking, the same substance: graphite and the diamond, being both carbon.

It is this wonderful softness, combined with persistent solidity, that enables us to smear it over any other solid surface, and thus obtain a solid paint, all body and no medium. For the class of castings to which it is commonly applied, where its application can be readily repeated, and where it is not exposed to the direct action of water, it is unrivaled as a protecting film to iron. Its chemical action, so far as it does act when cold, is reducing or anti-oxidising. Its color and tone are so similar to iron that Mr. Ruskin himself could scarcely make any æsthetic objections to its use, and the film is so marvellously thin that it obliterates nothing. I have never met with any attempt to estimate the thickness of a well brushed film of graphite, but I suspect that, if a hundred strata of such films could be piled in contact with each other, their combined thickness would fall short of that of the thinnest gold leaf.—*W. Mattieu Williams.*

The Magic of an Auctioneer's Advertisement.

The *Building News*, London, is responsible for the following:—An English country gentleman recently became tired of his house, and determined to sell it. He instructed an auctioneer, famous for his descriptive powers, to advertise it in the papers for private sale, but to conceal the location, telling persons to apply at his office. In a few days the gentleman happened to see the advertisement, was pleased with the account of the place, showed it to his wife, and the two concluded it was just what they wanted, and that they would secure it at once. So he went to the office of the auctioneer and told him the place he had advertised was such a one as he desired, and he would purchase it. The auctioneer burst into a laugh, and told him that that was the description of his own house, where he was then living. He read the advertisement again, pondered over the "grassy slopes," "beautiful vistas," "smooth lawn," etc., and broke out, "Is it possible? Well, make out my bill for advertising and expenses, for, by George, I wouldn't sell the place now for three times what it cost me."

HOT FILTERING.—The apparatus consists of a tube of soft sheet lead which can be wound around the funnel containing the filter in the form of a spiral. One end of the tube passes through a cork in the neck of a flask, in which water, or other liquid of higher boiling point, is boiled; the other end dips into a receiver into which the condensed liquid flows.

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Final Test and Opening of the St. Louis Bridge.

The final test of the strength of the St. Louis bridge was made on the 2d of July, under the supervision of Capt. J. B. Eads, the chief engineer. He was assisted by Col. Henry Flad, Oscar Scheultze, Messrs. Klemm, Varrelman, Schmidt, Cooper, and Devon, with ten assistants, and Mr. Schaler Schmidt, of the Baltimore Bridge Company. Col. H. B. Carrington, United States Army, Professor of Dynamic Engineering at Wabash College, was also present, and expressed his satisfaction at the result of the tests. At a given signal there were fourteen locomotives ready to obey the command of Capt. Eads and Col. Flad and their assistants. At about 10 o'clock seven locomotives, crowded with people on pilot, cab, and tender, moved in a body, coupled together, and ascended the approach; and when arriving on the two 56 feet spans over Front street and the levee, east of the abutment pier, they halted, and by a signal notified the other caravan of seven iron horses to come up to the rack; and they followed up, and the test was begun in earnest.

The following is Capt. Ead's summary of the result of tests made upon the Illinois and St. Louis bridge with fourteen locomotives:

"Seven locomotives were placed upon one track of each span. This produced a deflection of 2½ inches on center span and 2⅛ inches on each side span. Seven locomotives were then placed on each track of the west approach, and both trains of locomotives, fourteen in all, were moved out out abreast and simultaneously over each one of the three spans. The locomotives weighed from 35 to 51 tuns, averaging 40 tuns each, making 560 tuns in all. The two trains thus formed were stopped on each span, and the effects of this load carefully noted. The deflection of the middle span was 2½ inches; of each side span, 3 inches. The two trains moving abreast upon each arch was the severest possible test to produce distortion of the curve of each arch. Ten locomotives were then coupled together, and these were run over each track on each side of each arch of the entire bridge, covering the entire track of each span, and throwing the whole weight of the train, 400 tuns, on one side of each span. This test was applied to each side of the bridge, and produced the severest twisting strain to which each arch can be subjected. The vertical deflection produced by this test on the center span was two and one half inches. The locomotives thus coupled were run at a speed of ten miles per hour. The local traffic on the upper roadway of the bridge was uninterrupted during the progress of the tests. Various other observations in detail were made, noting the effects of the load on the arches as it entered upon and left the different spans, but this possesses no special interest to the general public. The result of the tests agreed almost exactly with the theoretical computations previously made, and the whole trial proved eminently satisfactory. The instruments failed to detect any side motion whatever during the tests."

The river is spanned by three arches, of which the central arch has a span of 520 feet, the other two of 502 feet each. The arches are composed of cast steel, and the bridge is really a double structure, consisting of two arches placed side by side. The arches are made of steel tubes, each twelve feet in length.

The formal opening of the bridge was celebrated on the 4th of July, with great enthusiasm. The display was finer than ever before witnessed at St. Louis. The procession was five hours in passing a given point. Addresses were made by Mayor Brow, ex-Senator Gratz Brown, Governor Woodson of Missouri, and Governor Beveredge of Illinois.

Contraction of Tyres.

M. L. Merlet proposes the following method of reducing the inner diameter of a tyre which has been unduly enlarged by the hammer or the rolls, so that it cannot be put on when hot in the usual manner. The plan consists of heating it to redness, and then plunging it horizontally but only to half its breadth in water, and leaving it there till quite cold. The operation is then repeated in the same position, after which the tyre is turned over and the heatings and plungings applied to the other half of the ring. The first cooling produces a contraction of which the half not immersed partakes, and thus undergoes a molecular retraction resulting in a reduction of diameter; of course the same is produced in the other half during the second operation. In this way a tire has been reduced 7 in 895. Four immersions instead of two will double the shrinking. In the same manner, a ring of Bessemer steel, which had not only enlarged under the hammer but had also become conical in form in the interior, was brought to the exact diameter by means of heating and immersing thirteen times successively, first the side that was contracted, and afterwards that which had become enlarged. In this case the correction amounted to nearly four inches, but the diameter of the steel ring is not given.

The Wear of Car Axles.

The standard car axle journals are 3¾ inches in diameter by 7 inches long. The old style was 3½x5½.

The superiority of the standard axle is illustrated by Mr. C. E. Garey as follows: "Two pairs of wheels, one with 7x3¾ journals, and the other with 6½x3½ journals, were left under the car in constant service, when I found it necessary to remove the wheels, as they were worn out, having run 65,734 miles. On examination, I found that the large journals had been worn off $\frac{1}{32}$ of an inch in diameter and $\frac{1}{8}$ in length, but were perfectly straight, smooth, and equal in size, while of the smaller ones, namely, 6½x3½, one was worn off $\frac{1}{16}$ in diameter and the other a little less, and both were smaller in the center than at the shoulders; while the lateral wear was the same as that of the large journals. I find by experiment that bearings on 5½x3½ journals will run from 30,000 to 35,000 miles, while the standard bearings, judging from the past twelve months' experience, will run with safety 100,000 miles or more, and with much less liability of heating, as we have several cars running with standard axles, and have not yet had a hot box. These experiments were made with New York and Harlem Railroad baggage car No. 10."

FROM 57 TO 86 MILES AN HOUR BY RAIL.—Fast time was recently made by the "newspaper train," which left Jersey city nearly half an hour behind time, and made it all up before reaching Trenton. This distance—a fraction less than 57 miles—was run in 59 minutes, including a stoppage of over a minute at Newark and a moderation of speed at New Brunswick. There were some portions where the speed was more than a mile and a quarter a minute. Just beyond New Brunswick, five miles were run in three and one half minutes, which is at the rate of nearly 86 miles an hour. About a dozen passengers enjoyed this extraordinary ride.

THE PRODUCTION OF PRECIOUS METALS on the Pacific Slope reached, during the last quarter of a century, $1,583,644,934, of which California mines produced three fourths, nearly all of which latter was in gold. The amount obtained is now increasing yearly, partly from the opening of new mines, but chiefly from the introduction of improved methods of extracting the precious metals from the ores. The yield of the Pacific Slope, last year, was $80,287,436, against $70,236,914 in 1872. The increase is mostly in silver, a much more useful metal than gold, except for coinage.

NEW BOOKS AND PUBLICATIONS.

EARTHWORK MENSURATION, ON THE BASIS OF THE PRISMOIDAL FORMULA, containing a Simple and Labor-Saving Method of Obtaining Prismoidal Contents Directly from End Areas. By Conway R. Howard, Civil Engineer. Illustrated. Price $1.50. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

The author of this book has developed a new system of finding the contents of earthwork by prismoidal mensuration, and accompanied the treatise with tables and rules of application of admirable simplicity, so that any one who can approximate cubic contents by the rough method of average areas can obtain a more exact result by the use of the prismoidal formulæ here given.

REPORT OF THE BOARD OF OFFICERS ON GATLING GUNS OF LARGE CALIBER FOR FLANK DEFENSE. Ordnance Memoranda, No. 17. Washington: Government Printing Office.

In this document, the views we have expressed as to the efficiency of the Gatling gun are fully endorsed by a board of experts in artillery. Detailed accounts of very many trials are given, and the results, illustrated by target diagrams, once more prove the terrible destructiveness of the weapon, especially in open country and as a means of defense.

A NEW METHOD OF AMALGAMATING THE PRECIOUS METALS. By John Tunbridge. Newark, N. J.: Pierson, Brother, & Co, 188 Market street.

Mr. Tunbridge is an expert in metallurgy, several of whose communications have appeared in our columns, and we refer our many readers who are interested in the subject to the little pamphlet now before us, as detailing some original views of a most important subject.

THE ELECTRO-ASTRONOMICAL ATLAS. By Rev. J. W. Spoor, A.M. Illustrated. Price $2. Rochester, N. Y.

The object of the author of this work has been to present the elementary principles of astronomy in a simple, popular form, as readily comprehensible by children as the ordinary primary text books on geography. We think that his efforts have been attended with excellent success. The volume before us is beautifully illustrated, written in a clear, concise style, in questions and answers, and presents the newest and most authentic information regarding the science. The diagrams are unusually complete and accurate, one exhibiting, at a single view, the entire solar system; while the other illustrations, original and selected, some of which plates are colored, are well calculated to convey correct ideas of the science of astronomy, in which, of late, there is so much interest.

Recent American and Foreign Patents.

Improved Sash Pulley.

Stiles E. Maxon, Long Branch, N. J.—The pulley case is cast in one piece and is made oval, to fit in the oval end of a mortise. The lower end is made concave to fit the fastening screw, which is tapered and has a small beveled head to arrest it when it comes flush to the stile of the frame; also to secure the lower end of the case. The screw being tapered, its threads will be pressed into the wood by the case when it comes into position, so as to insure its holding firmly.

Improved Loom Picker Spring.

William E. N. Potter, Lewiston, Me.—This invention relates to mounting a spring pulley (around which is wound the strap that connects it with the picker stick) on a crotched stand having a slotted base to adapt it to be secured to a screw stud in a vertical or horizontal position. It also relates to the means of securing the strap to the pulley case by a hook fastened in the slot in the face of the pulley by its bent portion and the straight extension, said extension being pressed in between the two coils of the spring, and kept in place by them. This arrangement allows of readily putting in the hook and taking it out, so that a broken or worn-out hook can be readily replaced.

Improved Watch Regulator.

Joseph W. Hurd, Grand Crossing, Ill.—The object of this invention is to furnish means for regulating watches by the application of a micrometer screw, so as to vary the hair spring, and consequently the running of the watch, in the most delicate and precise manner.

Improved Apple Crib.

James M. Chaplin, Middleport, N. Y.—This is an improved apple house or crib for use in the orchard, for the purpose of keeping or storing apples therein as they are picked from the trees until they are to be sorted and barreled for market. Hitherto it has been the custom with orchardists to pick their apples and put them in large piles on the ground, or directly into barrels. In the latter case, the apples will sweat, mold, and mildew, and, therefore, not keep as well, so that considerable loss is caused in both cases. The present invention consists of a crib constructed of a raised bottom with detachable ends, and intermediate cross sections, and adjustable sides covered by a roof, the whole being connected in suitable manner, so as to be readily put up and stored away after use.

Improved Toy.

Mortimer C. Lee, New York city.—This is a toy cart with a figure of a horse's head and neck (one or more) attached to the axle thereof, propelled by means of a tongue, and guided by means of reins. A pull upon either line changes the direction, and the effect is very similar to that of guiding a live horse, which makes the toy exceedingly interesting to the juvenile driver.

Improved Heating Apparatus.

Gustavus Stevens, East Tawas, Mich.—This invention consists in a new and improved method of heating and ventilating rooms, by drawing pure air from outdoors by means of a bellows actuated by a large clock gearing, and of forcing the same through heating coils enclosed in a cylinder. Said cylinder is provided with a flue in its center, up which passes the flame of a large lamp, by means of which the coils are heated, and is also enclosed in an outer case which may contain either water or air. By means of this arrangement the air in a room is maintained at a uniform temperature and a constant ventilation secured.

Improved Fence.

Jacob Haish, De Kalb, Ill.—This invention consists of a sheet metal fence rail spirally twisted and provided with spikes excised from the body thereof, and turned on opposite sides; also in a fence post made of two closely joined metallic rods bent outward at corresponding points near the base.

Improved Hay and Straw Cutter.

John A. Cornish, Marshfield, Mo.—This invention consists in improving hay and straw cutters by the application thereto of a grinding plate that takes up the wear on the knife as fast as it occurs, a peculiar support for the cutter blade, and also novel means for operating the feed rolls. These cause the machine to operate with less labor and to cut the hay or straw more uniformly than is usually done.

Improved Piston Packing.

Stillman E. Chubbuck and Isaac Y. Chubbuck, Boston, Mass.—This invention consists in the improvement of steam packing for pistons, by combining, with the spring pressers that hold the cut rings in place at their proper expansion, non-radial hub arms and overlapping ring studs to prevent lateral displacement, and also in the peculiar construction of the heads of spring pressers, so that they may act at right angles to one ring and exert also a lateral pressure upon the other, the two sets of rings that break joint with each other being thus held perfectly steamtight against the piston cylinder.

Improved Circular Saw Planing Knife.

Joseph T. Tunis, St. Michael's, Md.—This invention consists in a new and improved method of planing down the kerf upon sawn material during the operation of sawing, by inserting in grooved holes near the circumference of the saw detachable planing knives having symmetrical sides and projecting alternately on opposite sides of the saw just far enough to plane down the kerf without wasting the material, the said knives being made with symmetrical sides so that they may be taken out and reversed when one edge becomes dull or blunted.

Improved Bed Lounge.

Frank Johnson, Omaha, Neb.—The seat is hinged at the front part. The head part is hinged to an inclined head piece of the lounge frame, and is to be swung in an outward direction like the seat. The inside of lounge frame and seat are provided with suitable mattresses, the cushioned head and seat being at the under side when the lounge is used as a bed, and thereby not exposed to rapid wearing out. The hinged section is provided with folding legs. The face board is detachable, and has to be taken off when the lounge is folded into a bed. It closes the open part between the seat and frame, and is firmly applied to lugs which enter recesses, and pass along extension grooves by sliding a board sidewise toward the head of the lounge, retaining it firmly thereon till detached by sliding it in opposite direction for opening the lounge. The lounge is quickly and easily changed into a bed, and *vice versa*.

Improved Binder Attachment for Harvesters.

Willis Wheelock, Decorah, Iowa, assignor of one half his right to William T. Baker, same place.—This is an automatic raking attachment for harvesters, so constructed as to collect the cut grain into a gavel and raise it to the binders' table. Suitable construction enables the binder to equalize the gavels by allowing the rake to operate only when a proper amount of cut grain has fallen upon the platform. The rake stands still for a short time at each end of the platform and then moves across the platform in a straight line, sweeping the cut grain before it. As the rake head moves back its forward part is raised out of the falling grain. The forward part of the rake head, while sweeping the grain before it, is kept from rising. To the inner edge of the platform is pivoted an apron, which is connected with the spring so as to be lowered as the spring is forced down by the advancing rake, and allow the gavel to pass to the receiver. As the rake head rises to return, the apron is raised by the spring to prevent the grain from falling from the platform, while the receiver is raised to deliver the gavel.

Improved Carriage Wrench.

Wilbur F. Rowe, Minneapolis, Minn.—The object of this invention is to provide, for the removing and replacing of the axle nut of carriages, an improved wrench by which the same can be done without soiling the fingers or letting the nut come in contact with dirt. A carriage wrench slides on the shank of an axle nut socket. The shank is partly polygonal, partly round, and is provided with a button or knob, by which the nut and socket may be turned, while the starting or finishing turns of the nut are given by the lever part of the wrench.

Improved Burial Case.

Jacob H. Forshay, New York city.—By an improved mode of fastening the lid may be applied and taken off in a few minutes without difficulty, the connection being made by fastening clamps which are provided with tapering grooves, and placed over the dovetailed wedge strips at the sides and ends of the body and cover of the case. The adjoining parts of the body and cover are provided with interlocking grooves and tooth shaped projections, which extend around the whole circumference of the case, and have rectangular extension recesses, into which corresponding continuous strips of rubber are applied. By placing the cover on the body of the case, the apexes of the projections embed themselves tightly into the rubber lining, and form thereby a perfect and hermetically sealing joint as soon as the fastening clamps are applied.

Improved Mode of Connecting Pitmen to Fly Wheels.

James M. G. Mouck, Drakeville, Iowa.—A wheel has curved arms, one of which is provided with a slot. This construction adapts it for attachment of a pitman, by means of a wrist pin which passes through the end of a bar that is pivoted to the rim of the wheel, and is clamped in any adjustment by a screw nut. The slot is constructed upon a curve of a circle whose radius is the pivot of the bar. The object of the latter is to compensate for the loss, and prevent the breaking or giving way of the slotted arm, and also to overbalance the wheel on one side, so that it has no dead center.

Improved Toy Gun.

John C. Todd, Toronto, Can.—This invention consists of a disk-shaped piece of suitable material, provided with a groove along the circumference in which, by suitable fastenings, an elastic band is placed. A diametrical perforation of the disk serves as a guide chamber for the dart, the disk being provided at one end thereof with a segmental recess for easily taking hold of the end of the dart and the elastic band, and thus, by suddenly extending and then freeing the latter, sending out the projectile.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 12 to June 18, 1874, inclusive.

COOKING, ETC., BY LIQUID FUEL.—J. H. Thorp, New York city.
COMPOUND ENGINE.—W. Baxter, Jr., Newark, N. J.
DISTILLING EXTRACTS.—F. Walton *et al.*, New York city.
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TEMPERING STEEL [illegible] et al., Fitchburg, Mass

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ANSWERS TO CORRESPONDENTS

J. N. F. can copper his iron castings by using the recipe on p. 155, vol. 26.—L. C. will find a recipe for a good cement for leather on p. 119, vol. 28.—C. M. C. can repair his rubber bladder by following the directions on p. 208, vol. 30.—S. M. B. will find the wire gages described on p. 363, vol. 28.—Y. C. R. and all other readers of this journal ought to know that there is no machine for indicating buried gold, silver, or other treasure.—P. & F. B. are informed that the issue containing the account of the henery is out of print.—L. H. I. M. does not send data enough for the solution of his equation.—A. S. will find an explanation of the revolving wheel question on p. 27, vol. 28.—J. W. S., who enquires as to lenses and telescopes, has omitted to send his full address.—S. R. H. will find descriptions of tool steel on p. 21, vol. 31.—C. B. L. will find recipes for aquarium cement on p. 274, vol. 30.—P. H. C. will find directions for molding rubber on p. 363, vol. 30.

L. A. G. asks: Can you give me a good and cheap plan for constructing a cistern to gather soft water? I propose building one 30 feet long, and 10 feet wide and deep, lining bottom and sides with a 4 inch brick wall, laying the bricks in mortar of sand and fire clay (in equal quantities, mixed) with an arch on top, of 4 inch brick. A. A cistern built in this manner would not stand; a side wall 4 inches thick and 10 feet high, if built in a straight line, would be thrown down by the pressure of the earth on the exterior when the cistern is empty. A better way is to build it circular, say of twenty-two feet diameter, erect a brick pillar in the center of two feet diameter, and then throw the arch from the pillar to the exterior wall, extending around in a circle; in which case the span will be only ten feet, and the outside wall will resist the pressure of the earth. The crown should be some distance down from the surface of the ground, in order that the sides of the arch may be properly loaded. But even in this case it will be better to lay the bottom in two courses of brick, one on edge, and make the arch 8 inches thick.

G. C. R. asks how to remove ink stains from paper? A. Try a solution of chloride of lime in water.

W. A. D. asks: 1. Is there such a metal as Chabannean metal, an alloy invented by one M. Chabanneau, to imitate gold? A. Yes, metal so called is used in the manufacture of cheap jewelry. 2. Will it wear equally as well as gold with the same care? A. We cannot say, having no positive knowledge. Probably not 3. How can I tell pure gold from an article that is merely washed or lightly plated? A. By its specific gravity, that of gold being 19·34. The imitation will be much less. 4. What fluid is used by the tinmen to make solder stick to tin? A. Hydrochloric acid saturated with zinc.

J. H. C. asks: 1. What would be the result if the star Arcturus should strike the earth? A. The earth, as an earth, would probably be destroyed. 2. Can you give me a recipe for a varnish for canvas which will not be affected by the heat of the sun, or make the canvas stiff? A. We know of no varnish that will answer your purpose.

S. C. H. says: 1. I wish to paste common tracing cloth on a paper background. What kind of paste can I use? I have tried albumen, which admits of the cloth peeling off. A. Gum tragacanth might be used. 2. I also wish to varnish the glazed surface. What kind of varnish can be used? I have tried white dammar varnish, and it does not dry. A. Mastic will probably answer your purpose.

W. S. V. says: Can you tell me what the enclosed substance is? It was found floating in the water in large quantities near Montauk, L. I., last summer. Fire and acids seem to have no particular effect on it. I tried acids, hot and cold, and left it in a coal fire under the coals for two hours, and in a wood fire about the same time, and it came out of the coal fire a little more brittle than this specimen which I send, broken from the same specimen before trying it. This specimen has not been tested. It melts before the blowpipe with soda. A. It consists of a siliceous skeleton which loses a certain amount of organic matter on ignition. Distributed through the mass are particles of sand. It is likewise impregnated with saline matters. It appears to be the *debris* of marine organisms compacted together by the action of the waves.

D. O. C. asks: 1. How many ounces of blood will 1 gallon of rich fresh cow's milk make? A. No reliable computation has been made. 2. How can I make the common sulphur match? A. Take phosphorus 4 parts, water 10 parts, fine glue 6 parts, red ocher or lead 5 parts, smalt 2 parts. Mix the glue with a little water, and convert by a gentle heat into a smooth jelly; put it into a slightly warm porcelain mortar to liquefy; rub the phosphorus down through this gelatin at a temperature of about 146° to 150° Fah. Add the niter, then the ocher or lead, and lastly the smalt, until the whole forms a uniform paste. The sulphur match should be dipped into the mixture in the usual way.

W. J. S. asks: 1. Which is the best way to regulate the temperature of an incubator by means of balanced valves? I have tried to work them by mercury in a bottle, and a float up the neck connecting with the valve; but the mercury does not expand enough to work it. A. Lengthen your tube of mercury and the result will probably be more satisfactory. 2. What are the shells of eggs composed of, besides lime? My hens eat their eggs as soon as laid if not watched, shells and all. I think that they do not find enough lime in their food to make shell. A. Take a quantity of bones, burn and pulverize them, and mix with the feed; this will give the requisite quantity of phosphate of lime.

B. T. G. asks: 1. Do candy manufacturers use poisonous articles in the coloring of candies? A. It has been stated on good authority that nearly half the candy manufactured contains, in the form of coloring matter and otherwise, really poisonous matter, and this is principally in what is called French confectionary. 2. Are our commercial teas (called China and Japan teas) adulterated in this country? A. Yes, but to a somewhat limited extent. 3. Is beet sugar manufactured to such an extent in the United States as to be called an article of commerce? A. The manufacture of beet sugar in this country is as yet comparatively in its infancy, but it promises much. 4. Are there any manufactories of sirup by a chemical process, with muriatic or other acid, out of old rags, etc.? A. For many years chemists have made sugar in the laboratory in this way as a curiosity, but we know of no one who makes a business of manufacturing sirup by this method. 5. Is it probable that an expert can invariably tell (by a decoction), within one cent, the commercial value of any kind and grade of tea? A. We have very little doubt but that such men can be found.

O. N. asks: Is not the grass left on lawns cut by lawn mowers injurious to the lawns? Wherever the cut grass remains, the lawn looks thin, dry, and dead. If the decaying grass destroys that on which it falls, in time it would exhaust the soil. The lawn looks much better before being cut than after. A. The change is probably due to the atmosphere of gases, heat, etc. generated by the decaying or fermenting vegetable substances, grass, etc., also to the partial absence of light.

A. asks: How can I make a cheap microscope? A. Every convex lens is in itself a microscope; the only difference between it and the larger or compound instrument is that, instead of viewing the first formed image, a second and still more powerful lens is used, which receives the image and still further magnifies it. The cost of microscopes is due to the necessary extreme perfection of the lenses used.

J. P. L. asks: How can I test a cellar for dampness? A. The easiest way for you to test for moisture in your cellar will be to provide yourself with a thermometer, a glass tumbler filled with water, and a piece of ice; then notice how low your thermometer, when placed in the tumbler, has to sink before any moisture begins to show itself on the outside of the vessel of cold water. The lower the temperature to which the thermometer has to sink before moisture is precipitated, the less there is of it in the moisture of the cellar.

M. M. asks: In refitting the bearings of an engine lathe, how can I best set the mandrel and face plate in the right position to the bed plate? The face plate is 29 inches in diameter. A. If the bearings of your lathe head are to be Babbitted, as your question indicates, set the lathe head in position by placing a parallel bar of iron between the centers of the lathe and apply a large square to the rod and the face plate of the lathe, which will denote the exact position for the lathe head. If the journals are of brass and require renewing, mark off their hight (from the bed of the lathe) by a trammel made from the hight of the center of the poppet spindle to the bed, and then mark them sideways by means of a square placed across the face of the bed of the lathe, placing the edge of the square exactly even to the bearing of lathe bed wherein the lathe head fits. Or, in the latter case, you may use the old brasses as a guide for marking the new ones, making such allowances as practice or the lathe demonstrates to be necessary.

W. S. W. asks: What is the principle of Bude lamp invented by Benjamin Thompson (Count Rumford)? A. The Bude lamp is an argand lamp, through the center of the burner of which a current of pure oxygen gas is passed, which enormously increases the brilliancy of the flame.

A. N. H. says: 1. In plating with nickel, it sometimes chips off. What is the cause and how can I remedy it? A. Extreme care should be taken to thoroughly cleanse and coat evenly with copper, by immersion in solution of blue vitriol for a short time. If properly prepared, you will probably find no further trouble. 2. How is the solution kept always neutral? A. By keeping sufficient surface of the anode exposed in the solution. 3. How is ivory dyed blue? By keeping the ivory immersed in a dilute solution of sulphate of indigo, partly saturated with potash, for some time. This will give you a fine blue.

W. B. V. says: Parties selling gasoline burners sell also a formula or recipe for preparing the gasoline, to render it safer: powdered alum, soda, salt, etc. But the seller also offers it already prepared at 40 cents per gallon. Is all of it stuff necessary to render the gasoline safer or better, or is it to insure the sale of it at 40 cents? Is not pure gasoline as safe as the mixture? A. No mixtures of this character impart safety. No burning oils are safe except those of high specific gravities and boiling points.

W. F. W. asks: Will a band saw take the place of a common straight mill saw for sawing lumber from hard and soft wood? A. Band saws are used for the above purpose with much success. See illustrations of ship timber band saws in SCIENTIFIC AMERICAN, p. 175, vol. 28.

O. C. L. asks: 1. How can I make a simple self-registering anemometer? A. There are several forms of this instrument; the most usual consists of a small vane with fans, which the wind turns; the velocity is deduced from the number of turns made in a given time, which is measured by an endless screw and wheel work. 2. How can I prepare paper which will be discolored at any point by the simple passage of a moderate current of electricity through it? A. Soak the paper in a solution of iodide of potassium and starch. 3. Will you give me a recipe for making lemon sugar that will not injure the health? A. Use tartaric acid and powdered sugar in the proportion of one to four.

J. J. H. asks: Can you give me a good and cheap recipe for making laudanum? A. Take of opium (moderately fine powder, dried) 2½ troy ozs., water and alcohol each, 1 pint; diluted alcohol sufficient quantity. Macerate the opium for three days with the water with frequent agitation, then add the alcohol and continue maceration for three days more. Introduce the mixture into a percolator, and, when liquid has ceased to pass, pour the diluted alcohol upon it until 2 pints have been obtained.

W. W. asks: What is the length of 8 centimeters in inches? A. 3·1496+ inches.

F. M. B. says: I have a self-inking job printing press; and when I undertake to print a large form (the type being evenly planed and impression screws being evenly adjusted), I get an impression on only one side of the form, and the same is true when I undertake to print a small address card. Is there a simple method by which I can ascertain if the plate is perfectly parallel with the platen? A. The fact that your form gives an impression on one side only is proof that the platen is not set parallel with the bed, and the fault can only lie in the adjustment screws of the platen. The maker of the press can undoubtedly supply you with a gage to set the platen, but proper adjustment of the platen screws will (if the faces of the bed and platen are true) set them perfectly parallel to each other and give an even impression.

T. D. asks: Is there any market for sumac in bales, unground, and is there a way to get its properties in a liquid form? A. There are many varieties of this shrub, some of which are used in tanning and dyeing, and some in medicine. It is used also instead of galls in the manufacture of ink. Rhus wine is also made from this. The market for it is very limited, and the supply exceeds the demand.

G. M. asks: Is there any such thing as a mermaid living in the sea? If so, where can it be found and to what class of fish or animals does it belong? A. Descriptions of several such monsters were anciently published, but Sir Humphrey Davy asserts that a human head, *mammæ*, and a fish's tail are absolutely incompatible in one body.

A San Francisco gentleman says (in commenting on our reply to C. H. M., who asked: "Which is the healthiest State in the Union?" in which we said: That State in which the greatest regard is paid to religion, law, and education. In respect to physical advantages, most are in the first rank): "You bigoted asses, what has religion to do with health to a sensible man?" A. Our correspondent will peruse for his enlightenment the death rates of ministers of the Gospel, of Quakers and of communities professedly following a religious life, with those of his acquaintances among the various "hells" for which San Francisco was at one time mostly celebrated.

A. J. S. asks: Does the wind ever change directly from the east to the north, or does it always go around by south and west to the north? A. The wind may change from the east to the north, or from east to south and thus to the west. If it follows the latter course, the clearing of the weather is regarded as permanent. If it changes from east to north, the weather is regarded as uncertain.

W. H. W. asks: To what uses is verdigris applied? A. Verdigris in an impure state is much used as a green pigment. In the pure state, it is employed in medicine.

N. H. says, in reply to a correspondent who asked how to take the dirt off a machinist's hands, some time ago: I find that sawdust is good. Put on a coat of good soap, then rub it off with pine sawdust.

J. S. K. says: I cured a rusty tea kettle as follows: I got a piece of quick lime about as large as my fist and slacked it in the tea kettle that evening, filling the kettle full of water and letting it stand on the warm stove; the next morning I emptied the lime water into a bucket and rinsed the kettle, and it was used during the day as usual; at night the lime water was poured back into the kettle and warmed, and the next morning again poured out, and so repeated, the next night making three nights in all, and that tea kettle was cured! It has not shown a symptom of rust in the water since. I will state that every night the kettle is emptied and left open to dry.

C. R. says, in reply to a correspondent who asked for explanation of "jerked" beef: The whites who settled Central and South America found beef, used by the Indians, dried in long strips, and it is so prepared by the Guachos and others to this day. The native name for it is *charqui*, and *charqui* beef in English speech very soon and easily became "jerked" beef.

P. D. R. says that the spoon and tumbler experiment can be tried with the same tumbler by first trying the tumbler with the spoon in it, and then, if the hot water does not break the glass, trying the same glass (after it has returned to its normal state) without the spoon. If it breaks then, the inference would be that the spoon saved the glass.

F. C. R. says that poke root (*phytolacca decandra*), sliced thin and laid about a house, will destroy cockroaches quicker than any other poison. It never fails.

T. D. says: Your answer to P. D. R., p. 395, last volume, about the spoon and tumbler, has placed you in a dilemma from which you might be extricated by trying first the spoon in the tumbler and then pouring in the hot water; and if the glass did not break, then try the tumbler alone. If it broke, then find out the reason why. This spoon and tumbler business is an instance of how remarkably prone men are to take up half an idea without trying to find out the principle involved. Why does hot water break a tumbler at all? Answer: Because the glass heated at one place expands too rapidly for the unheated part and breaks. But if you take a spoon, or anything else, and prevent the sudden heating of the bottom of the tumbler by gradually pouring the hot water and heating the sides as fast as the bottom, you will probably save the tumbler.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

A. says: Enclosed is a specimen of what seems to be one rose growing out of the center of another. There is another example of the same on the same bush. A This abnormal rose is not of a character sufficiently unusual to rank it among monstrosities. The second rose is upon a continuation of the stem. In some instances the second flower is found upon a shoot issuing from below the calyx. This is sometimes noticeable among rhododendrons.—F. M.—One specimen consists of delicate crystals of carbonate of copper. The other consists of a quartzoze rock, stained with silicate of copper and containing a little magnetic oxide of iron.—J. H.—It is basanite or touchstone. It is a flinty jasper, u on account of its hardness and black color for tryi the purity of the precious metals. The color left o the stone after rubbing the metal across it indicates to the experienced eye the amount of alloy.—M. F. F.—No. 1 is specular iron ore. No. 2 is blende or sulphid of zinc in quartz.—C. H. B.—It is a variety of brown hematite, or the hydrated sesquioxide of iron.

F. K. asks: Can you give a recipe for making good Bologna sausages?—G. W. F. asks: How are the suction bellows placed in a parlor reed organ? By what mechanism are the pedals kept in an upright position? How is the tremolo fan made, and where is it placed?—C. asks: Is there anything in the shape of green japan in use, or what is the green paint that will stand baking?—G. F. L. asks: Will some one tell me how to bud rosebushes?—A. J. asks: How many square feet of surface should a parachute have to sustain a man's weight, say 150 lbs., in the air?—W. W. asks: What is Spanish wax?—J. F. A. asks: How thick is the helmet used by divers? How is the water kept out? How is it fastened to the diver's head?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Boiler Explosion in Michigan. By M. A. K., and by K. P. C.

On Electricity and Magnetism. By C. E G

On Solar Attraction, etc. By S. W. R.

On an Arrow Head. By C. M. B.

On a Lunar Atmosphere. By W. F. Q.

On Light, considered Metaphysically D. H. B. Jr.

On Early Steamboats. By D. R. P.

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Also enquiries and answers from the following:

J. E.—D. E.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

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June 16, 1874,

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,100.—TRANSFERRING CARS.—W. Wharton, Jr. Sept. 2.
30,103.—HARVESTER RAKE & REEL.—McClintock Young, Jr. September 2.
30,234.—PLANING VALVE SEATS.—C. B. Long. Sept. 16.

EXTENSION GRANTED.

28,755.—PORTFOLIO.—J. Nelson Jacobs.

DESIGNS PATENTED.

7,491.—OYSTER DISHES.—J. W. Boteler, Washington, D.C.
7,492.—GAS BURNER.—E. Evans, Lynn, Mass.
7,493.—GLASS BOWLS.—A. H. Heisey, Pittsburgh, Pa.
7,494.—SHOW CASES.—A. Holthaus, St. Louis, Mo.
7,495 & 7,496.—CENTER PIECES.—S. Kellett, San Francisco, Cal.
7,497.—HEATING STOVE.—A. Wemyss, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,831.—CIGARS.—R. C. Brown, New York city.
1,832.—COTTON DUCK.—Brinckerhoff & Co., N. Y. city.
1,833 & 1,834.—BAGS AND DUCK.—Brinckerhoff & Co., New York city.
1,835.—PREPARATION OF TRIPE.—Gall & Co., Cincin., O.
1,836.—CEMENT.—J. C. Harris & Co., Philadelphia, Pa.
1,837.—STEAM ENGINE.—Herchelrode & Hill, Dayton, O.
1,838.—STOVE POLISH.—Hoppings, New York city.
1,839.—LUBRICATING OILS.—Wells & Co., Parkersburg, W. Va.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
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On filing each application for a Patent (17 years)	$15
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On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
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On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

JUNE 10 to 15, 1874.

3,541.—W. L. Horne, Chicago, Ill., U. S. Machine for regulating the pressure of gas and other fluids, called "Horne's Pressure Regulator for Gas and other Fluids." June 10, 1874.
3,542.—J. W. Ricker, Sherbrooke, P. Q. Improvements on a washing machine, called "Ricker's Washing Machine." June 10, 1874.
3,543.—Y. M. C. Johnson, Franklinsville, Randolph county, N. C., U. S. Improvements in shoemaker" combination tools, called "Johnson's Improved Combination Tool for Shoemakers' Use." June 10, 1874.
3,544.—T. Hazard, Wilmington, Clinton county, O., U.S. Extension of No. 2,598, first period. "Hazard's Straw and Hay Cutter." June 10, 1874.
3,545.—T. Hazard, Wilmington, Clinton county, O., U. S. Extension of No. 2,598, second period." "Hazard's Straw and Hay Cutter." June 11, 1874.
3,546.—I. P. Magoon, St. Johnsbury, Caledonia county, Vt., U. S., and H. Fairbanks, same place. Reissue of No. 2,736, for "Magoon's Locomotive Feed Water Heater." June 15, 1874.
3,547.—J. H. Wentworth, Boston, Suffolk county, Mass., U. S. Improvements in portable ranges and cooking stoves, called "Wentworth's Portable Rauge or Cooking Stove." June 15, 1874.
3,548.—H. Jefferson, Toronto, York county, Ont. Composition of matter to be used in the manufacture of artificial stone or marble, called "Patent Victoria Stone." June 15, 1874.
3,549.—C. H. Hutchinson, Manchester, N. S., U. S. Improvements on balanced valves for steam engines, called "Hutchinson's Improved Balanced Valve." June 15, 1874.
3,550.—D. H. Packard, Brockton, Plymouth county, Mass., U. S. Improvement on boxes for the toes of boots and shoes, called "The Packard Molded Box Toe." June 15, 1874.
3,551.—J. T. Jones, Ilion, Herkimer county, N. Y., U. S. Improvements in treadles for sewing machines, called
3,552.—J. Gould, Clinton, Allegheny county, Pa., U. S. Improvement in animal traps, called "Gould's Animal Trap." June 15, 1874.
3,553.—M. B. Marcum, Cameron, Clinton county, Miss., U. S. Improvements on car couplings, called "Marcum's Car Coupling." June 15, 1874.
3,554.—B. T. Babbitt, New York city, U. S. Improvements on processes for coating caustic alkalies, called "Babbitt's Process for Coating Caustic Alkalies." June 15, 1874.
3,555.—B. T. Babbitt, New York city, U. S. Improvement in caustic alkali packages, called "Babbitt's Caustic Alkali Package." June 15, 1874.
3,556.—W. H. Bond, Syracuse, Onondaga county, N. Y., U. S. Improvements on a hot air furnace, called "Bond's Hot Air Furnace." June 15, 1874.
3,557.—J. C. Waterhouse, Sherbrooke, P. Q. Improvements on sewing machines, called "The Climax Sewing Machine." June 15, 1874.
3,558.—E. H. Murray, St. Paul, Ramsey county, Minn., U. S. Improvement on food from wheat, and process for preparing the same, called "Murray's Granulated Wheat." June 15, 1874.
3,559.—C. C. Barnes, Sackville, Westmoreland county, N. B. Improvements on rotary pumps, called "Barnes' Rotary Pump." June 15, 1874.
3,560.—J. D. Patton, Treverton, Northumberland county, Pa., U. S. Improvements on apparatus for manufacturing gas, called "Patton's Apparatus for Manufacturing Gas." June 15, 1874.

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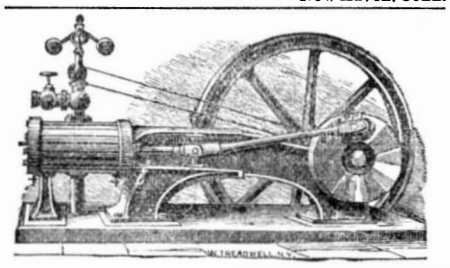

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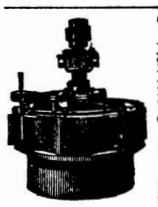

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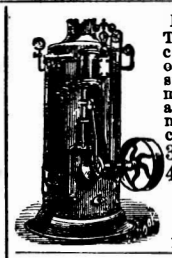

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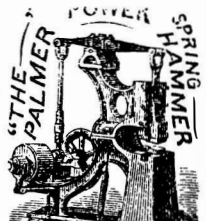

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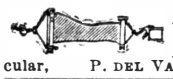

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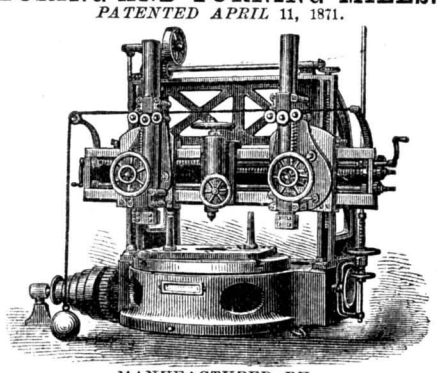

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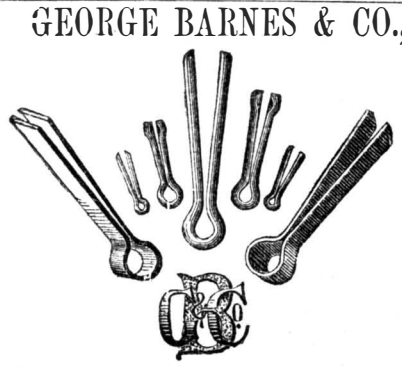

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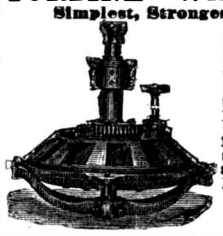

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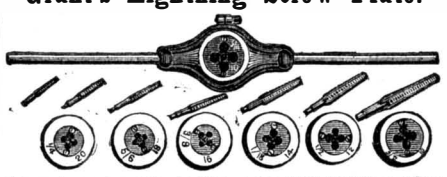

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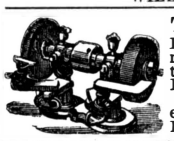

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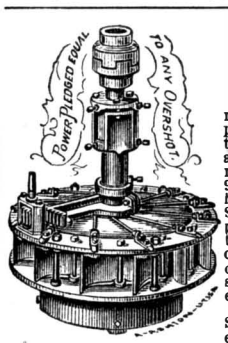

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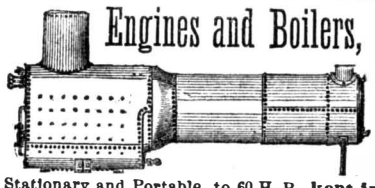

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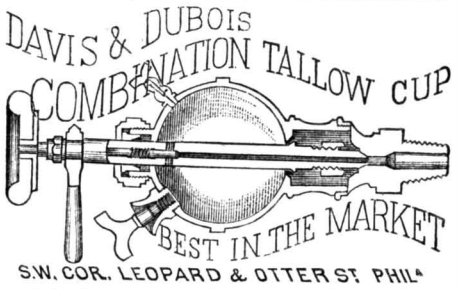

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